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JPRS Report

Nuclear Developments

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JPRS-TND-88-016

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Nuclear Power Chief Seeks Foreign Cooperation

HK0108010688 Beijing CHINA DAILY (BUSINESS WEEKLY) in English 1 Aug 88 p 1

[By staff reporter Yuan Zhou]

[Text] The Chinese nuclear industry will continue to stress co-operation with foreign partners in the further development of power plants, said Jiang Xinxiong, the head of the Chinese nuclear industry in an interview with "Business Weekly."

Jiang, 57, was the last leader of the recently disbanded nuclear industry ministry, and he is now chief executive of one of the few Chinese business giants—the China General Corporation of the Nuclear Industry.

The corporation was set up to replace the ministry as part of China's current reform process to separate government and enterprise functions.

Instead of being preoccupied with keeping China's nuclear arsenal on a par with those of other powers, Jiang said his corporation is aiming to turn the previously defence-oriented nuclear industry into a profitable business.

While still seeking to improve the capabilities and technology of the Chinese nuclear arsenal, the corporation, which employs 300,000 people, is converting 80 percent of the country's nuclear enterprises to civilian production. The industry is currently concentrated in remote western regions, but bases are being moved to coastal areas so the industry can play a full part in the nation's economic development.

The corporation's main task at present is to learn how to build and manage power plants so as to lay the foundation for the further self-reliant development of nuclear power coupled with assistance from foreign countries in the field of needed technical know-how, said Jiang.

It is estimated that by the end of the century, the country's nuclear power plants will have a total capacity of between 4.5 million and 6.7 million kilowatts. Nuclear power could be a major source of energy in China by the year 2040.

"The development of nuclear power in China is inevitable because of the growing needs of economic expansion and other factors such as shortages in some non-renewable resources, limited transport capacity and the danger of environmental pollution," Jiang said.

He predicted that by the end of this century, the country's nuclear power capacity will have been increased by between 100 and 200 percent. Work is going on at the Qinshan Nuclear Power Plant, where a 300,000-kilowatt capacity reactor is being built, and at Daya Bay Nuclear Power Station, where the reactors will have a total capacity of 1.8 million kilowatts.

Jiang admitted that although China had produced its own nuclear weapons, it still lacked experience in building nuclear power plants and needed to introduce foreign technical know-how to ensure safety and quality.

At Qinshan Nuclear Plant, which is being built by Chinese, some key equipment worth 40 percent of the total equipment cost will have to be imported from Japan and Germany because Chinese machinery is below standard and the work cannot be held up, Jiang said.

The Daya Bay plant in Guangdong Province is using nothing but foreign technology and equipment.

However, in order to reduce costs, China has to gradually localize the building of nuclear plants, he added.

Production of power plants should be standardized in order to attract more customers.

Reactors similar to the two 600,000-kilowatt reactors being built as part of the second phase of the Qinshan project in Zhejiang Province will be produced in small quantities for commercial use. Their design and manufacture will be standardized and serialized, said Jiang.

Fujian, Shanghai, Hainan, Liaoning, Nanjing and other eastern provinces and cities are conducting feasibility studies on nuclear power plants because of the serious electricity shortages in those areas. Shanghai and Hainan are planning to build nuclear power plants by introducing foreign technology and investment.

But, Jiang said, in view of the country's financial constraints at present, nuclear power plants will be given less priority than thermal and hydroelectric power stations.

Nuclear Fusion Study Reaches Advanced Level

HK1008054288 Beijing ZHONGGUO XINWEN SHE in Chinese 0723 GMT 8 Aug 88

[Report by reporter Xiao Longlian (5618 7893 5114): "China's No. 1 Controlled Fusion Device' Reaches World's Advanced Level"]

[Text] Chengdu, 8 Aug (ZHONGGUO XINWEN SHE)—Li Zhengwu, a Chinese expert in controlled nuclear fusion, and honorary director of the 585 Institute of Nuclear Industry, revealed days ago that: The study for more than three years indicates that "China's No. 1 Controlled Fusion Device" has reached and surpassed the experimental targets stipulated in the first phase of construction. This achievement illustrates that the development of China's study on controlled nuclear fusion has reached a new level.

At present, the study on controlled nuclear fusion is one of the main directions of study of the world's scientific and technical circles. On the basis of the principle that the sun and other stars will release energy, this study tries

to make the instant nuclear fusion effects brought about by the explosion of a hydrogen bomb a controllable process, so that the energy released can be fully used by mankind.

"China's No. 1 Controlled Fusion Device" is a controllable nuclear fusion device designed, developed, and installed by Chinese scientific research personnel. It was completed, and started operation in September 1984.

When it started operating, scientific and technical personnel conducted joint readjustment of the overall construction, and physics experimental study. The first batch of results of the experiments were obtained in 1985, and they smoothly passed state appraisal and were accepted by the state. The parameters obtained by this device in various experiments in the last year have reached and surpassed the experimental targets stipulated in the first phases of construction. The means to identify the devices of the experiments, and the equipment for obtaining various parameters were increased from a few, when it was just started, to some 20 types. Besides, it has also taken up two experimental research projects entrusted by the international atomic energy organization.

Li Zhengwu claimed that: "China's No. 1 Controlled Fusion Device" has reached an advanced level compatible to that of the same device in the rest of the world.

Nuclear Safety Supervision Standardized

OW2908193488 Beijing XINHUA Domestic Service in Chinese 0528 GMT 29 Aug 88

[Text] Beijing, 29 Aug (XINHUA)—China is gradually standardizing its nuclear safety supervision with the formulation and establishment of regulations and systems for nuclear safety. This year, the Nuclear Safety Administration, guided by the State Council's "Regulations on the Management of Safety Supervision of Nuclear Equipment for Civil Use," has so far formulated the "Detailed Rules on the Implementation of Safety Supervision in Nuclear Power Plants," the "Report System of Operating Units in Nuclear Power Plants," and the "Report System for Regional Supervision Stations," thus stipulating principles, targets, and basic requirements for the supervision of nuclear safety.

At the same time, the Nuclear Safety Administration has directed the Suzhou Nuclear Safety Center, which uses foreign reference materials, to compile a "Supervisor Manual" and a "Supervision Manual." Suzhou Nuclear Safety Center is also undertaking the task of, by using reference materials from the International Atomic Energy Agency, compiling a set of documents on ensuring the quality of supervision. The documents lay down the specific scope, contents, and methods of safety supervision.

The regulatory documents and documents for implementation are thus instrumental in the supervision of nuclear safety. They provide a legal basis and basis for standardization of nuclear safety supervision.

In May, the Nuclear Safety Administration began its first application of standardized supervision when inspecting the low-temperature nuclear heat reactor at Qinghua University. Nuclear experts held that this standardized supervision will provide the basis and method for future supervision and inspection of this heat reactor. This form of standardized safety supervision can also be applied at other nuclear power plants and nuclear facilities.

Daya Bay Nuclear Safety Committee Planned

HK0508140888 Beijing ZHONGGUO XINWEN SHE in Chinese 1232 GMT 4 Aug 88

[Report by correspondent Zhang Xu (1728 6079)]

[Text] Hong Kong, 4 Aug (ZHONGGUO XINWEN SHE)—At an interview today with this reporter, An Qingming, who is in charge of the Guangdong Nuclear Power Joint Venture Company, said: In view of the importance of—and Hong Kong people's concern for—nuclear safety in the construction and operation of the Daya Bay Nuclear Power Plant, a "Nuclear Safety Consultative Committee for the Guangdong Daya Bay Nuclear Power Plant," consisting of Hong Kong professionals and well-known people, will be set up at Daya Bay on 12 August.

It has been reported that the constitution of the "Nuclear Safety Consultative Committee for the Guangdong Daya Bay Nuclear Power Plant" stipulates: The committee is a special body of communication between the Guangdong Nuclear Power Joint Venture Company and Hong Kong residents on matters relating to nuclear safety at the Daya Bay Nuclear Power Plant. Its duties include discussing the reports of the Guangdong Nuclear Power Joint Venture Company on the implementation of the regulations guaranteeing nuclear safety in the construction and operation of the Daya Bay plant; transmitting information about developments in the plant's nuclear safety to Hong Kong residents; and making suggestions and proposals in accordance with the rules and regulations of China's State Nuclear Safety Administration and in light of the actual conditions in Daya Bay, using nuclear safety-related materials of international atomic organizations as reference.

A source said: The committee will have 11 to 15 members. Apart from two people, who come from the China Nuclear Industry General Corporation and the Guangdong Daya Bay Nuclear Power Joint Venture Company in charge of liaison matters, the rest of the staff will be composed of Hong Kong professionals and well-known people in medical, engineering, educational, and environmental protection circles. The Guangdong Nuclear Power Joint Venture Company is responsible for inviting committee members. It has been reported that Wo

Po-yan and Raymond Ho Chung-tai have accepted invitations and been entrusted with the task of taking charge of the first committee, on which members will sit for terms of 2 years.

As early as September 1986, when the Hong Kong Nuclear Power Inspection Group visited Beijing, it proposed to Vice Premier Li Peng that a Daya Bay nuclear safety consultative body be set up, and it obtained Li Peng's support. Last April the China Nuclear Industry General Corporation issued a circular instructing the Guangdong Nuclear Power Joint Venture Company to invite Hong Kong professionals and well-known people to prepare to establish the consultative body. With support from all sides concerned, the work has progressed smoothly and now all the pieces are already in place.

Daya Nuclear Committee 'Responsible to People'
HK1308091788 Hong Kong HONGKONG STANDARD
in English 13 Aug 88 p 3

[By S. Y. Wai]

[Text] The newly established Sino-Hong Kong consultative committee on the \$28.8 billion Daya Bay project will be responsible to the six million people of Hong Kong. And committee members will inform locals of any developments concerning the safety of the nuclear power plant project "at once."

These were the assurances given by the chairman of the committee, Mr Wong Po-yan, yesterday at its inauguration ceremony in Shenzhen.

The Nuclear Safety Consultative Committee for the Guangdong Daya Bay Nuclear Power Plant was set up under the plant's developer, the Guangdong Nuclear Power Joint Venture Company (GNPJVC) on the instructions of the Chinese Nuclear Industry General Company (NIGC).

The committee is responsible to discuss the GNPJVC's reports on safety measures and their implementation during the construction and operation of the plant. These facts should also be communicated to Hong Kong people.

Another task is to make recommendations and comments on nuclear safety, subject to the regulations of the National Nuclear Safety Administration (NNSA). Relevant nuclear safety information of the International Atomic Energy Agency must also be taken into account as well as the actual conditions of the plant.

Speaking after the inauguration, committee chairman Mr Wong Po-yan said he believed the 12 Hong Kong members would report on Hong Kong people's worries to the committee from time to time. Even though 12 of

the 14 members were from Hong Kong, there would be no office in the territory to collect local opinions, he said. Mr Wong said members would collect opinions individually.

"We have ears to listen to people and eyes to read newspapers, and that will be how we collect opinions which will be discussed in the committee," he said.

Mr Wong said he would ask fellow members what information they needed and then proceed from there for the first meeting.

Asked about the support from two-thirds of members for any committee recommendation to go to the NIGC, Mr Wong said this requirement would not be applied to the release of information to Hong Kong people.

He assured that information about any incidents at the plant would be relayed to Hong Kong immediately.

On the committee's lack of power to monitor the plant, Mr Wong stressed that it was a consultative body which had no legal right to do so. That responsibility lay with the NNSA instead.

The GNPJVC's general manager, Mr Zan Yunlong, said the right to monitor and the right to supervise could not be separated from each other.

"The committee surely can't have the power to supervise, so it will be effective if it only has the right to monitor. That's why it is a consultative body which we believe will function well," he said.

Echoing Mr Zan's view, Mr Wong said it would be meaningless to argue over whether the committee should monitor the plant.

On the status of the committee, both GNPJVC officials and Mr Wong dismissed the accusation it would not be independent from Chinese nuclear authorities.

Hong Kong anti-nuclear activists have strongly criticised the lack of independence of the committee as everything concerning the setting up of the committee was decided solely by China.

But GNPJVC executive director Mr An Qingming said the fact that China took such a decision did not mean the committee would not be independent.

"Somebody has to organise and form the committee from scratch," said Mr An.

Mr Wong said that the committee would work independently and it would be responsible to both Hong Kong and mainland people.

Meanwhile, the Hong Kong Nuclear Investment Company, a shareholder in the GNPJVC, said the setting up of the committee showed that the Chinese leadership was concerned about the safety of Hong Kong people.

The committee has also received the Hong Kong Government's backing.

The Secretary for Economic Services, Mrs Anson Chan, said the Government welcomed the establishment of the committee. She believed the committee would play a useful role in improving communications between the Chinese nuclear authorities and the operator of the plant and the Hong Kong community.

"It will provide an opportunity for Hong Kong people to express their views on the operation and safety aspects of the Daya Bay Nuclear Power project and to keep abreast of developments on this front."

The 14-member committee comprises Hong Kong professionals and other prominent people who are participating in their personal capacity.

Government 'Welcomes' Group

OW1308053888 Beijing XINHUA in English
1431 GMT 12 Aug 88

[Text] Hong Kong, August 12 (XINHUA)—The Hong Kong Government welcomes the establishment of the Nuclear Safety Consultative Committee (NSCC) for the Guangdong Daya Bay Nuclear Power Station, said a government official today.

A ceremony was held today at the construction site of the nuclear power station to officiate the set-up of the advisory body, which is expected to play a useful role in improving communications between the Chinese nuclear authorities and operators of the Daya Bay Nuclear Power Station and the Hong Kong community.

Among the 14 members of the committee, 12 come from Hong Kong, including legislative councillors, professionals, academics, and environmentalists.

Mrs Anson Chan, the secretary for economic services, said she believed that the committee "will provide an opportunity for Hong Kong people to express their views on the operation and safety aspects of the Daya Bay Nuclear Power Project and to keep abreast of developments on this front," she said.

The station, whose twin reactors will produce 900 megawatts each, is being built on the Daya Bay site, 52 km northeast of Hong Kong. It is due to begin generating electricity in October 1992.

More than a half of the station's electricity will be transmitted into Hong Kong.

The Sino-Hong Kong joint venture has recently increased the number of quality control inspectors, and the construction schedule is being closely followed, it was announced today.

No Decision on Disposal of Daya Nuclear Waste

HK1508113188 Hong Kong SOUTH CHINA
MORNING POST in English 15 Aug 88 p 1

[By Andy Ho]

[Text] Radioactive waste from the Daya Bay nuclear power station is to be stored on the site for at least the first 10 years. Top officials of the Sino-Hong Kong joint project have yet to decide on how to dispose of the waste in the long-term.

Hong Kong's most senior executive at Daya Bay, Mr William Stones, said the Guangdong Nuclear Power Joint Venture Company (GNPJVC) had ruled out dumping the nuclear waste into the sea. But the utility's 15-member executive committee remains undecided on the permanent disposal of the potentially hazardous uranium waste.

Mr Stones pledged that the GNPJVC would adhere to current world practice in handling spent nuclear fuel from its twin 900-megawatt reactors, at present under construction about 30 kilometres northwest of the border. He said the company was still weighing the merits of two viable options—storage in remote underground caverns or reprocessing.

"Since the power station will not enter service until 1992 and provision has been made for temporary site storage of waste for about 10 years, there is adequate time for waste disposal plans and facilities to be completed," said Mr Stones, the first deputy chairman of the scheme.

He explained that intermediate and low level waste will be compacted and mixed with concrete before being placed in radiation-resistant drums for on-site storage.

Another concrete layer can be added to the outside of the drums as an extra precautionary measure. The waste will then be stored in containment buildings before being transferred to a strictly controlled dumping area in a remote area. Highly radioactive spent nuclear fuel rods from the reactors, on the other hand, will be stored in ponds to allow time for the most active materials to decay. They will later be removed from Daya Bay in heavily shielded casks.

"The fuel will then either continue to be stored in remote underground caverns or be reprocessed," said Mr Stones.

The GNPJVC, as the operator of the \$28.8 billion Daya Bay station, is responsible for handling radioactive waste while on site. When the waste leaves the site, however, it will be the responsibility of China's nuclear authorities to ensure safety for its transport, disposal, storage or reprocessing.

Surveys are underway in China to identify suitable disposal locations.

"The basic requirements for storage of high level waste and spent fuel," said Mr Stones, "are underground repositories deep in stable geological formation in remote land areas, perhaps in the far northwest of China".

In the case of reprocessing the active waste will be diluted to a very small fraction of the original volume of the rod.

The GNPJVC is negotiating with Chinese and French nuclear fuel producers on supply contracts for the Daya Bay facilities.

A member of the newly-established Sino-Hong Kong Nuclear Safety Consultative Committee, Dr Raymond Yeung Man-kit, said temporary on-site storage of radioactive waste was a common practice. The Massachusetts Institute of Technology-qualified nuclear engineer said radioactive waste was usually returned to the fuel supplier for reprocessing. But Dr Yeung added that he had no idea whether the same arrangement would apply to Daya Bay.

Guangdong Nuclear Safety Committee Forming
OW0408175688 Beijing XINHUA in English
1429 GMT 4 Aug 88

[Text] Shenzhen, August 4 (XINHUA)—A nuclear safety consultative committee for the Guangdong Nuclear Power Station will be inaugurated August 12, XINHUA learned today.

The committee will consist of representatives of the China Nuclear Industry Corporation and the Guangdong Nuclear Power Joint Venture Company Ltd, as well as experts from Hong Kong.

The committee will be organized according to a decision by the former Ministry of Nuclear Industry on account of Hong Kong residents' concern over the safety of the Guangdong Nuclear Power Station.

The station, now under construction, is located at Daya Bay, near Shenzhen in Guangdong Province and close to Hong Kong.

Acceleration of Civil Nuclear Programme Reported

51004015 Hong Kong HONG KONG STANDARD in English 26 Jul 88 p 6

[Text] Beijing: China appears to be planning an acceleration of its civil nuclear programme before the year 2000, but wants to avoid foreign aid as much as possible, Western experts here said yesterday.

Apart from nuclear stations being built or planned at Daya Bay and Qinshan, reactors with a total capacity of 1,200 to 3,400 megawatts will be built by the turn of the century, the communist party newspaper PEOPLE'S DAILY said last week.

But no bids have been invited from foreign companies for these projects and no nuclear station was included in the sixth five-year plan for 1986 to 1990, Western experts said.

The reports in the PEOPLE'S DAILY seem to announce an acceleration of the Chinese nuclear power station programme, which was frozen by the government in 1986 because of the lack of hard currency to finance it, analysts said.

The newspaper quoted the head of the Chinese nuclear industry, Jiang Xinxiong, as saying China intended establishing nuclear stations with a capacity of 4,500 to 6,700 megawatts by the end of the century.

"China wants to do without foreigners for the nuclear stations to come," said the Beijing representative of a major Western company specialising in civil nuclear power.

"It considers foreign bids too dear and says it can now do the work almost as well by itself."

China is currently building its first big civil nuclear power station, with a capacity of 1,800 megawatts, at Daya Bay, near Hongkong.

Daya Bay uses French and British technology and equipment and is due to be finished in 1992. A 300-megawatt reactor is being built at Qinshan, 120 kilometres south of Shanghai, and two more 600-megawatt units are planned.

The West German Kraft Werk Union (KWU), a subsidiary of the giant Siemens company, and the French firm Framatome are bidding to construct these two.

But Western industry sources here say negotiations have dragged on since last year with no concrete result in sight.

"At the start, the Chinese demanded that foreigners build most of the project," one industrialist said. "Little by little, the part reserved for the foreigners shrank. When the contract is signed, they will be lucky to get 30 percent of the project."

China hopes to take advantage of the technology transfers at Daya Bay to master Western techniques and do without future foreign help in its nuclear programme, Western experts said.

At the end of last year, then vice-premier and now Prime Minister Li Peng said China would increasingly use Chinese equipment to build its nuclear power stations.

China was already "basically capable" of producing all the necessary equipment, he said.

The PEOPLE'S DAILY said the provincial authorities in Jiangsu, Fujian, Jiangxi, Hunan, Hainan and Jilin all said they wanted nuclear power stations.

Before 1986, China said it would have a total nuclear capacity of 10,000 megawatts by the year 2000.

But Western experts believe that, whatever happens, coal and hydro power will for a long time remain the principal providers of electricity.—AFP

/9604

HONG KONG

Government Urged To 'Tell Public' About Daya Safety Plan

51004016 Hong Kong HONG KONG STANDARD in English 19 Jul 88 p 5

[Text] The Hongkong Institution of Engineers yesterday urged the Government to tell the public of its progress with the Daya Bay nuclear plant contingency plan.

The plan is outlined in the Harwell Report released in May this year and recommends measures Hongkong could take to prepare for a nuclear accident.

The institution concluded the plan followed international practice in its approach and carried useful information.

It also said the report laid down a basis for a contingency plan.

The institution's nuclear engineering division identified several areas of a scientific nature in the report which needed to be clarified or substantiated.

It agreed with the finding that plans for evacuation were not needed due to the distance between Hongkong and Daya Bay.

The Harwell Report, published by the UK Atomic Energy Authority, recommended the Hongkong Government plan for the introduction of measures other than evacuation, particularly those designed to prevent the consumption of contaminated food.

It also said it was necessary to set up an organisation to monitor and assess any release of radioactivity, decide and act on countermeasures, and keep the public informed of the situation.

79604

Local Power Official Defends Daya Bay Panel

HK0908013788 Hong Kong SOUTH CHINA MORNING POST in English 9 Aug 88 p 2

[By Andy Ho]

[Text] Hong Kong's most senior man at Daya Bay has defended the integrity of a cross-border advisory panel being set up by his company at Shenzhen to advise on the safety aspects of the nuclear power scheme.

Environmental activists are sceptical of the panel, whose membership and jurisdiction are defined by the utility company which will operate the future Daya Bay facilities. But Mr William Stones, first deputy chairman of the Guangdong Nuclear Power Joint Venture Company, last night described the committee members as those who had the interests of Hong Kong at heart.

The members, mostly from Hong Kong, are selected by the joint venture company, which is responsible for the \$28.8 billion Daya Bay nuclear power plant now being built about 30 km northeast of the border.

Speaking after a New Territories Rotary Club meeting, Mr Stones said: "The members are all highly professional, very competent and sincere people who work very hard for Hong Kong.

"I have no reason to suspect any of them will do anything other than to show their integrity by challenging what we do.

"Somebody has to select the members somehow," he said, adding that his company would welcome any challenge from the panel.

"We in Daya Bay ought to be capable of being challenged. We are quite happy to accept that."

Mr Stones also pledged to furnish the committee with adequate information on the project and said the panel would serve as a good communication link to inform the Hong Kong public of developments at Daya Bay.

Members will also study reports from different overseas nuclear authorities to ensure that safety measures at Daya Bay are up to international standards.

Mr Stones is also the managing director of the China Light and Power Company, which holds a 25 percent stake in the Daya Bay joint venture with China through its fully-owned subsidiary—Hong Kong Nuclear Investment Company.

Although not a member of the Sino-Hong Kong advisory panel, Mr Stones will deliver a statement to the group's first working session at the joint venture group's headquarters in Shenzhen on Friday.

The list of members on the panel has yet to be finalised but the names identified so far include Legislative Councillors, Mr Wong Poyan and Mr Stephen Cheong Kam-chuen. The Chinese Ministry of Nuclear Industry and the joint venture group will also be represented on the panel.

POLAND

Handling of Plutonium at Wroclaw Facility Decried 51003004 Warsaw PRZEGLAD TYGODNIOWY in Polish No 20, 15 May 88 p 14

[Article by Kazimierz Zakrzewski, professor emeritus, former director of the Radioimmunology Department at the Swierk Institute of Nuclear Research, former scientific secretary of the United Nations Scientific Committee for Investigating the Effects of Atomic Radiation, former chairman of the Federation of Biochemical Societies: "Alpha at Polon" under the rubric "Pole-nics"]

[Text] In her article "Alpha at Polon" (PRZEGLAD TYGODNIOWY, No 9, 1988), Grazyna Mikolajczyk opened a Pandora's box. For it turned out that more than half a million smoke detectors containing a radioactive element, plutonium, are hanging over the heads of our country's population. They serve, or are supposed to serve, to warn against the danger of fire. When many years ago at a United Nations scientific committee we gathered data on the use of radioactive materials in consumer appliances, we also received reports on smoke detectors whose active element was various radioisotopes: natural uranium, so-called depleted uranium, americium, or xenon, but never plutonium. This ensued besides not from any prohibition but from properly understood self-interest: investors erecting office buildings, warehouses, etc., were aware that they would have problems in renting them out were the news to spread that plutonium was present on the premises.

Plutonium is the most menacing of all known radioactive elements. It emits alpha-radiation, i.e., high-energy heavy particles. When inside living tissue, these particles spend all their energy over a path several to a dozen or more millimeters long, which causes a living cell adjoining the path of the alpha-particle to have little chance of remaining undamaged. As a result, alpha-radiation is bound to be several to a dozen or more times as likely to cause cancer as gamma- or x-radiation.

For a better idea of the danger of plutonium, it should be added that alpha-radiation is difficult to detect in local conditions. Plutonium is an extremely longlived element (its half-life is 25,000 years) and it is the most toxic of the known elements, more toxic than the hydrogen cyanide by a factor of about 1,000,000.

In Wroclaw there is a plant manufacturing smoke detectors that contain plutonium. That plant lacks the materials needed to eliminate plutonium in the event of a breakdown, and it does not have a sufficient number of sensors for detecting plutonium. When contamination with plutonium was discovered last January, it took as long as a week before a person authorized to formally record the contamination appeared at the offices of the Polon Plant. It took another week before the local "Sanepid" [Sanitar, -Epidemiological] station was notified, which can be likened to notifying the fire department of a fire 10 [as published] days after it was observed.

The plant's employees were long unable to find out whether they were or were not contaminated, because many laboratory medical tests "did not take," as the expert on these matters declared. That expert is unaware that it is not possible for a plutonium detection test "not to take" if it is performed by one of the methods used throughout the world and if the laboratory performing it is properly organized.

A plant administrator declared that the reason for the contamination was mechanical damage to the smoke detector, "e.g., striking it with a hammer." He was zealously seconded by another administrator, who claimed that the detectors are fine but the "stupidity" of the users is without limits. These administrators are unaware that a plutonium-containing device should withstand not only being struck with a hammer but also falling from considerable height onto a concrete floor. Just who then is displaying that "stupidity"?

This whole affair is bound to prompt reflections. Of a certainty, it should not be glossed over by the administrators of our nuclear energy centers. Isotope-containing devices are widely used in present-day technology, and even in daily life. Hence, they should be designed and built in a manner that would maximally protect human health and the environment against the harmful effects of atomic radiation. Polish smoke detectors do not meet this requirement. Before they are released for use, they should be thoroughly inspected, especially from the standpoint of the health of users. But this is not being done, and the expert who has for year been responsible for radiological safety admits with Olympian detachment that smoke detectors are not worth testing. Lastly, there should exist an efficient service for the detection and immediate elimination of contamination. The Wroclaw incident has shown what it is like in practice.

The Polish population is being protected against noxious manufactured goods by specialized services (so-called services for testing utile objects) administered by the ministry of health. Even such simple objects as plastic breakfast bags must be tested before they can be sold by retail outlets. But this does not apply to smoke detectors, under which thousands of people move daily without even being aware of the potential peril. For products containing radioactive isotopes are tested not by the health service but by the Central Laboratory for Radiological Safety (CELOR).

The nuclear manufacturing industry in Poland is a coherent whole: the Swierk Reactor and Isotope Production Center (ORIPI) produces isotopes; the POLON Plant installs them in smoke detectors (and other products) and CELOR decides whether they are safe to humans. All these three institutions are under a single agency—the State Atomistics Agency. The monopoly of production along with unity of production and control certainly afford good conditions for plan fulfillment, but to the detriment of users (and technological progress).

ARGENTINA

Reports of Nuclear-Powered Engine Denied

PY1508221488 Buenos Aires NOTICIAS

ARGENTINAS in Spanish 1530 GMT 15 Aug 88

[Text] Buenos Aires, 15 Aug (NA)—Today Balvino Zubiri, chairman of the Chamber of Deputies Defense Committee, stated that "I am not aware" of the construction of a compact nuclear-driven engine to be installed in a submarine.

In remarks to Radio Rivadavia, Zubiri stated that at least \$1 billion would be necessary for such a project and that "that sum far surpasses" the Argentine budget.

However, today nuclear physicist Jose Federico Westerkamp said: "I suppose" that that engine is being built at the Applied Research Institute (INVAP) installation, which is controlled by the CNEA and the Rio Negro government.

Westerkamp explained that this engine is reportedly being financed by "secret Armed Forces' funds," and that "the National Border Police must also have" this type of account.

Reliable sources recalled that the last military government implemented this type of project. However, the project was suspended by the democratic government in 1983 due to, among other things, its cost.

During the Malvinas war, the Navy decided it needed a nuclear-driven engine due to the superiority of British atomic submarines during that war.

Last year Jorge Sabato, former vice foreign minister and current education minister, told the magazine SOMOS that Argentina would like to join the Brazilian project to build a nuclear-fueled submarine, a desire never addressed publicly. However, the two countries are engaged in an integration process.

Asked about a rumor that Argentina was building a compact engine for nuclear submarines, Zubiri stated: "Our country, in fact, has the technical ability to carry out projects of this type."

He added that "technologically highly-developed conventional weapons are being sold now."

"Argentina has highly-developed technology in this sector, but what that physicist is saying," he said ironically, "is a well-kept secret because I truthfully am not aware of it."

"And much less that a huge amount of money will be invested in this project, as reported," he said.

Zubiri added: "This does not mean that the report is incorrect, but I am totally unaware of any project of this nature."

When he was told that the investment would amount to \$2 billion, he said that "this amount is not in keeping with our situation, especially at this moment."

Zubiri denied the existence of secret Armed Forces' funds. "At best, there can be military secrets as in any country in the world, but I do not believe that they include secret accounts."

Defense Minister Denies Nuclear Submarine Plans

PY1908005888 Buenos Aires TELAM in Spanish

2232 GMT 18 Aug 88

[Text] Buenos Aires, 18 Aug (TELAM)—Today Defense Minister Jose Horacio Jaunarena denied that Argentina is manufacturing a nuclear submarine. He added that there is a great misunderstanding on the matter.

Jaunarena talked briefly with reporters at Government House after a meeting with President Alfonsin to discuss routine matters, as he said.

He added that some of those matters were of greater importance to his ministry, such as the budget implementation and plans to reorganize the Armed Forces, which are discussed on a weekly basis.

In answer to a question, the defense minister denied that Argentina is manufacturing a nuclear submarine. He said that there is a great misunderstanding on this matter: Most people do not fully understand what a nuclear submarine is.

When a submarine is mentioned, the propulsion system is actually what is in question, but the fact that a submarine is propelled by nuclear energy does not mean that it carries nuclear weapons. In the case of Argentina, no nuclear submarine is being built, Jaunarena said without giving further details.

CNEA Denies Construction of Nuclear Submarine

PY1708115788 Buenos Aires TELAM in Spanish

0110 GMT 17 Aug 88

[Text] Buenos Aires, 16 Aug (TELAM)—The CNEA has issued a warning about a psychological, national, and international campaign which seeks to involve Argentina in warmongering ventures. This follows reports on the alleged construction of a nuclear submarine.

Tonight the CNEA Public Relations Office released a communique which states that the report by an Argentine physicist in Chile, denouncing the construction of an atomic submarine and talking about a nuclear specialty he has no experience in, is part of this campaign.

The communique says that the different groups that are trying to link the construction of a fuel reprocessing laboratory and the uranium enrichment plant with the manufacturing of weapons are also part of this campaign.

The communique recalled that the CNEA fulfills the purposes for which it was created, dedicating all its efforts to the peaceful use of nuclear energy. These efforts have resulted in many technological developments that have improved the population's standard of living, within the framework of technological independence, and far from any secret purpose of manufacturing weapons.

The denial of the CNEA comes on top of the denial last night by a Defense Ministry authorized spokesman, who said that the report which stated that Argentina would spend \$2 billion on the construction of a nuclear submarine was unthinkable and crazy. The spokesman added that Argentina uses its technology for peaceful purposes.

CNEA Head on Nuclear Submarine Reports, Plants

*PY2008034088 Buenos Aires TELAM in Spanish
2351 GMT 19 Aug 88*

[Text] Buenos Aires, 19 Aug (TELAM)—Emma Perez Ferreira, chairman of the CNEA, has categorically denied that a nuclear submarine is being constructed in local shipyards. Emma Perez also asserted that the Embalse nuclear plant is operating fully, while the Atucha I plant, paralyzed due to problems in the cooling system, will resume activities in 20 days time.

Perez Ferreira made this statement during a news conference with members of the CNEA consultative board at the commission's headquarters at 8200 Libertador Avenue in Buenos Aires.

Regarding the statement by scientist and nuclear physicist Jose Westerkamp that a nuclear submarine is being built at the Ministro Manuel Domecq Garcia shipyard, in Puerto Nueva, Perez Ferreira said that it is completely untrue.

The CNEA chairman said that if we do not have the necessary resources in our nuclear energy program to complete the Atucha II plant, we certainly would not be involved in projects that are not only useless, but condemnable.

We have no intentions, she explained, at least I personally do not, and you can ask the president (Raul Alfonsin), of producing atomic bombs and the same for the submarine that is being represented as a nuclear submarine. What would be interesting is a submarine propelled by nuclear energy.

Regarding the situation of the Atucha I, Embalse, and Atucha II nuclear plants, the CNEA chairman said that the first two are operating, although Atucha I is momentarily paralyzed for another 20 days due to a problem in the cooling system. The Embalse plant is operating fully, and a close check is being kept to prevent problems such as those that appeared in the pressure vessels of similar Canadian nuclear plants.

In this regard, she said that there are no leaks in any of the vessels because had there been, the plant would not be operating. She added that there is minimal leakage of heavy water, caused by a leak in one of the vapor generating tubes, but this by no means should cause unrest to the people.

Regarding the construction of Atucha II, she said that it is 60-percent complete. We are seeking to obtain partial financing, which we have already started to negotiate, to cover expenditures during the next 2 years. Currently, the authorities of the economic sector want to secure financing to cover the completion of the project, which means that there will be a change in the way we carry out negotiations.

Asked about what she termed a "campaign to discredit the CNEA," Perez Ferreira said that the publication of reports on nuclear activities, which are always negative, is very systematic. She added that: We should also like to talk about the good things we do.

Perez Ferreira concluded by saying that there are many antinuclear people; therefore, when I talk about the existence of such a campaign, it is probably nothing but the pressure exerted by these groups or commercial interests that could be seeking to paralyze our activities to keep countries from using new nuclear energy.

Nuclear Policy Committee With Brazil Meets

*PY0508021688 Buenos Aires TELAM in Spanish
1953 GMT 04 Jul 88*

[Text] Cordoba, 4 Aug (TELAM)—Official sources have reported that the "Argentine-Brazilian Permanent Committee on Nuclear Policy" held its opening meeting here today. During the meeting, the committee discussed important common issues on nuclear policy and agreed to integrate the capacity of the two countries and promote the building of "fast breeder reactors."

In view of technological advances in the exploitation of energy resources, both delegations agreed that nuclear energy is a reliable possibility and stressed the conclusions on environmental impact that have been reached in recent meetings. The committee confirmed that generating electricity at nuclear plants with appropriate safety measures causes little environmental pollution.

The meeting was chaired by Susana Ruiz Cerutti, international relations secretary of the Foreign Ministry, and by Sebastian do Rego Barros Netto, Brazilian Foreign

Ministry undersecretary for economic and trade affairs. It was also attended by other officials of the Argentine and Brazilian Foreign Ministries and by members of the atomic energy committees from both countries.

A decision has been made to establish a reciprocal environmental monitoring system, independent of control measures that are already enforced in the respective countries. The system will ensure that nuclear plant emissions do not harm the environment in either country.

Businessmen from the nuclear sector submitted to the "committee" a request to eliminate customs duties on several materials produced in both countries and necessary for the construction of the Angra II and Atucha II nuclear plants in Brazil and Argentina, respectively. This request was accepted by the binational committee because the elimination of customs duties will help strengthen bilateral nuclear trade.

Deputy on Damage at Embalse Nuclear Plant
PY1908214688 Buenos Aires BUENOS AIRES
HERALD in English 19 Aug 88 p 11

[Text] Yesterday Lower House fuel and energy Committee Secretary Normando Arcienaga (Peronist-Salta) asked the executive branch to report to Congress on the extent of technical damage that has been detected at the Embalse nuclear plant in Cordoba. The Salta legislator went on to question the sense of spending hundreds of millions of dollars to repair the most modern plant in Argentina, which ceased to generate electricity for a period of at least 23 months. The problems at Embalse were brought to light by an article which appeared in the BUENOS AIRES HERALD yesterday. The article pointed out that there were failures in the Embalse piping system and that the plant needed urgent repairs.

Nuclear Plant Out of Service for 20 Days
PY1908005088 Buenos Aires NOTICIAS
ARGENTINAS in Spanish 2105 GMT 18 Aug 88

[Text] Buenos Aires, 18 Aug (NA)—The Atucha I nuclear plant will be out of service for 20 days. According to reliable sources, "this means that if it does not rain in the next 5 days, the whole power system will be in crisis." This is why the authorities are preparing a "program of measures" which include "interrupting the electricity service for shop windows and electric advertising signs."

The same sources said that "the public will be informed of the situation in the next few days" as a consequence of the interruption of the Atucha I nuclear plant services. The announcement will be made before the implementation of the "extreme measures that will be adopted."

The sources told NOTICIAS ARGENTINAS that the absence of rain lately has reduced the generation of electricity, a situation that will be exacerbated by the shutdown at the nuclear plant.

"If it does not rain in the next 5 days, these two factors will place the electricity system in a very critical situation, which will prompt the authorities to adopt extreme measures," the sources said.

Sources said that the current situation is "much more serious" than the one the country went through a few months ago, which forced the authorities to implement a program of alternating power outages.

The sources said that some of the measures include "the interruption of electricity to shop windows and advertising signs," and they even hinted that "it is very probable" that television broadcasts will be restricted.

Heavy Water Spill Reported at Atucha I Plant
PY1708023488 Buenos Aires DYN in Spanish
2010 GMT 16 Aug 88

[Text] Buenos Aires, 16 Aug (DYN)—Today a Buenos Aires evening newspaper reported that an accident at the Atucha I nuclear plant, which is located 100 km from Buenos Aires, caused 50 tons of heavy water to spill inside the steel and cement container that houses the reactor and the steam generator of the plant.

The accident occurred earlier this year and forced the Argentine Government to turn to the international black market, apparently to Libya or Sudan, to purchase 8 tons of heavy water, according to an article published on the front page of EL HERALDO DE BUENOS AIRES.

The article, which is signed by Osvaldo Gazzola, comments on the frequency of this type of accident at the two nuclear plants operating in Argentina: Atucha I and Embalse Rio Tercero, which is located 110 km south of the capital of Cordoba Province.

The article, which is based on information obtained from highly reliable scientific sources, notes that the spilling of 50 tons of heavy water at Atucha I did not cause any danger of contamination or a nuclear disaster like those at Three Mile Island, U.S., and Chernobyl, USSR.

The newspaper says that the amount of heavy water spilled represents one-sixth of the Atucha I stock, and it caused a significant loss of approximately \$15 million. A kilogram of heavy water costs \$300. This figure is doubled or tripled on the international black market.

The article reports that the CNEA purchased 8 tons of heavy water on the international black market to overcome the problems caused by the accident. The 50 tons of spilled heavy water were sent abroad (possibly to the FRG) to be purified.

The newspaper makes it clear that heavy water is not radioactive in its initial form; that is, it is not contaminating but it becomes radioactive as soon as it is used—even if only once—as a coolant or moderator in the nuclear fission process.

Scientist Comments on Nuclear Program

PY1808165988BuenosAiresDYNinSpanish0248 GMT 18 Aug 88

[Text] Buenos Aires, 17 Aug (DYN)—Today scientist Jose Federico Westerkamp reported the existence of cracks in the stainless steel container the reactor of the Atucha I nuclear plant. He also reiterated that Argentina "is in optimum condition to immediately put into operation" a submarine powered by atomic energy.

Westerkamp, special investigator of Conicet [National Council for Scientific and Technological Research] and professor of nuclear physics, said that cracks in Atucha I were detected during the administration of Eng Alberto Constantini. Last year Constantini resigned as CNEA president due to budget cuts in the organization.

In an interview published on the first page and inside the afternoon daily EL HERALDO, Westerkamp explained the need for a "debate by the entire society" about the "convenience of spending so much money" on nuclear plants which "provide only about 10 percent of the total energy consumed in the country."

He based his proposal of a debate on the fact that the Atucha II nuclear plant, "after it is concluded, will end up costing about \$4 billion," and that 1 kilowatt in the fusion [as received] nuclear process will cost 5.8 cents in contrast to 1.7 cents for the same energy produced by a hydroelectric plant.

Westerkamp said that the cost study did not include "the general expenditures or the ecological consequences of a large nuclear accident, the system of protection, and the nuclear waste depot which will have to be implemented when the nuclear plants go out of service."

Regarding the controversial information that Argentina plans to build a nuclear submarine, which was categorically denied by the Defense Ministry and CNEA, Westerkamp said that he has "information, from reliable sources, which is the term used by reporters, that a compact motor run by atomic energy was tested in one of the submarines in the Domec Garcia shipyard."

He said that the information, which was later denied, is based on the "positive test" conducted in the plant of INVAP (Applied Research Institute, which is funded mainly by the CNEA) for making 10 to 30 megawatt small reactors, which "can be used perfectly well for running a submarine."

BRAZIL

SBPC Proposes Closer Monitoring of Parallel Program

51002031c Sao Paulo O ESTADO DE SAO PAULO in Portuguese 13 Jul 88 p 12

[Text] A group of scientists at a meeting of the SBPC [Brazilian Society for the Advancement of Science] yesterday suggested that a civil committee be set up to monitor Brazil's parallel autonomous nuclear program. They advocated the need for the National Congress to monitor these operations, with the direct participation of technicians and specialists from universities.

According to physicist Luiz Pinguelli Rosa, an opponent of the Brazilian-German agreement and one of the critics of the parallel nuclear program, this committee would be responsible primarily for conducting inspections of the Brazilian agencies that are not part of the system of safeguards of the International Atomic Energy Agency (IAEA), such as the Aramar Center, the Institute for Research in Nuclear Energy, and the Technological Aviation Center at Sao Jose dos Campos. According to the report presented at the SBPC: "It is not enough to have a constitutional provision stating that nuclear energy is to be used for peaceful purposes if there are no technical means to control operations under the aegis of the Congress."

The Brazilian Government has agreed to safeguards only for the reactors at Angra dos Reis and for the reactors being used for research of the fuel cycle under the Brazilian-German agreement. "Our proposal," physicist Pinguelli explained, "is to set up a civil monitoring system for internal safeguards in all facilities that are not governed by international agreements. The system would come under the National Congress, it would have a high-level scientific advisor, independent of the Executive power, and would be required by law to request the advisory services of universities and research institutions, using the National Nuclear Energy Commission's laboratories."

09805

Angra I To Resume Full Operation in November

51002031b Rio de Janeiro O GLOBO in Portuguese 9 Jul 88 p 23

[Text] The Angra I nuclear plant, which has been shut down since 26 July 1987, will begin operating again at full capacity on 1 November 1988, to relieve the system for supplying power to Rio de Janeiro, thereby reducing the risk of blackouts. The director of operations of Furnas, Roberto Haig, reported that generation of 626,000 kw at Angra is part of the program to supply power to the southeastern region, and is essential to ensure a supply of power without problems.

Last Thursday, 7 July, the Civil Defense for the third time conducted tests on the four sirens located within a radius of 5 km of the plant, at Angra dos Reis. These tests are conducted every 6 months, and this is the first time that the sirens have been activated simultaneously, according to the Ministry of the Interior's social communications advisor for the southeastern region, Elizabeth Sarmiento.

The local people were notified of the tests 15 days in advance; 11,000 explanatory pamphlets were distributed to avoid panic. The sirens, with a volume of 120 decibels each, will be activated in the event of an accident at Angra I. With this plant in operation, the Civil Defense is going to step up its campaigns to explain procedures in the event of an accident.

The technicians at Furnas have been struggling for the past 3 years to make the nuclear plant operational, but a number of defects, primarily due to design errors on the part of the manufacturer, Westinghouse, have caused constant interruptions of its operations. 1985 was the only year that the plant remained in operation throughout the year, with no problems. The latest defects occurred in the steam generator and the electrical generator. Furnas has brought suit against Westinghouse over the steam generator problems, accusing it of fraud and negligence. Furnas expects to win the suit and receive compensation of the order of \$100 million.

09805

Energy Shortage Necessitates Angra II Operation in 1993

51002031a Rio de Janeiro O GLOBO in Portuguese
10 Jul 88 p 45

[Article by Sonia Mossri]

[Text] Brasilia—An energy squeeze is beginning to be felt and the government is already convinced that Angra II will have to be in operation by 1993. In confidential studies conducted by government experts under the

auspices of the National Security Council, the conclusion was reached that there was no alternative hydroelectric power source to eliminate the specter of rationing and the possibility of blackouts in the southeast in the 1990's.

Besides the fact that there is not enough time for an alternate hydroelectric power source to meet demand in the southeastern region, there is another basic problem: a shortage of resources. Even if it were possible to build a new hydroelectric power plant to supply the region (which would take about 6 years), it would cost over \$6 billion, which would be more expensive than putting Angra II into operation.

Construction of Angra II, originally scheduled to begin operating this year, is in an advanced stage and nearly all the equipment has been purchased and is in storage. Because of the many delays, entailing a revised construction timetable and heavy losses in equipment storage for Nuclebras, it is much cheaper for the Union to plan on having Angra II begin operations at the start of 1993.

The critical point of Angra II is contracting an electro-mechanical erector, a key part of the nuclear plant. According to an estimate by experts involved in redefining the Brazilian nuclear program, this operation will cost at least \$250 billion. In the next few days, Finance Minister Mailson da Nobrega, Mines and Energy Minister Aureliano Chaves, and Planning Minister Joao Batista de Abreu should be meeting with the top representatives of the National Security Council to evaluate this final matter.

Experts working on Brazil's nuclear program have also looked into the possibility of privatizing Nuclep and Nuclemon, subsidiaries of the Nuclebras group. So far, however, the prospects do not look good, even if Japanese companies would be interested in transferring technology for the separation of rare earths, an operation done by Nuclemon. And even if they should agree, some government sectors have reservations as to the condition imposed by the Japanese to participate in this operation: namely, that part of Nuclemon's production go to supply their own market.

09805

EGYPT

High Official Reportedly Involved in Dumping Nuclear Waste

51004607 Beirut AL-KIFAH AL-'ARABI in Arabic
25 Jul 88 p 11

[Text] An Arab country has exact details regarding the involvement of a high Egyptian official in a deal calling for the burial of nuclear waste in various desert regions of Egypt in return for various services and sums. Also, this official is an associate of the irresponsible Sudanese president Ja'far Numayri in a trade project which extends beyond his activities in the Egyptian area.

These details reached an Egyptian agency, which immediately began "destroying" [quotation marks as published] the waste, as the above-mentioned official is one of influence.

INDIA

Minister Reports Nuclear Power Generation Plans

BK1708135388 Delhi Domestic Service in English
0830 GMT 17 Aug 88

[Text] The minister of state for science and technology, Mr K. R. Narayanan, assured the Lok Sabha today that all possible measures will be taken to protect ecology and environment while setting up nuclear power plants. All safety standards will also be adhered to.

Replying to supplementaries during the question hour, Mr Narayanan said about 10,000 megawatt of atomic power is to be developed in the country by the turn of the century. He said, however, energy resources being limited in the country, there is a need for developing nuclear energy to supplement power generation from other sources.

Atomic Energy Official on Nuclear Projects

BK0508101588 Delhi THE HINDUSTAN TIMES in English
24 Jul 88 p 1, 12

[By Rajendra Prabhu]

[Text] Bombay, July 23—Atomic Energy Commission Chairman Dr M. R. Srinivasan has refuted the charge that India was stockpiling plutonium for "nuclear bombs in the basement."

In an extensive interview with this correspondent at the headquarters of the Department of Atomic Energy [DAE] next door to the Gateway of India, Dr Srinivasan said that "quite a lot of plutonium would be needed for starting the fast breeder reactors when we would commission them in the next seven or nine years. He estimated the requirement at 2,000 to 4,000 kg for the 500 mw fast breeder reactors.

The Nuclear Power Corporation under the DAE was planning to build at least two fast breeder reactors of 500 mw capacity each in the coming decade and more would be built in the first and second decades of the 21st century. Plutonium is obtained by reprocessing the waste fuel rods from the first generation thermal power plants which use natural uranium as fuel. Plutonium is part of the fuel that would be fed into the fast breeder reactors. Though Dr Srinivasan did not specify it, India's existing reprocessing facility at Tarapur is stated to produce just 25 kg of plutonium in a year. One more reprocessing plant is coming up at Kalpakkam, Madras.

"If you have to use this much plutonium, you have to accumulate it over the years, not overnight," the Commission chief who is also Secretary of the Department of Atomic Energy, said.

Referring to the allegations in the Western Press regarding clandestine import of heavy water Dr Srinivasan said that they appear to be motivated to malign India. It was "evident we do not have to do any such thing," he stressed recalling the capacity in this complex technology already built up through various heavy water plants at Nangal, Tuticorin, Baroda, Talcher, Kota, Thal etc. Indian heavy water capacity was now next only to that of Canada, the world's largest heavy water producer, he added.

The Commission Chairman stoutly denied any attempt by the DAE to underestimate nuclear power generation cost.

While he did not want to enter into a controversy with the Comptroller and Auditor-General of India whose report on the Madras Atomic Power Plant had doubted the cost estimates of the DAE for nuclear power generation, Dr Srinivasan pointed out that any attempt to subsidise nuclear power could not be hidden as the subsidies would build up into a large sum when as much as Rs 13,000 crore were being spent on the 10,000 mw nuclear power programme. "We are not subsidising nuclear power. We have no intention to underestimate it either," he said.

Justifying the decision to accept the Soviet offer for two 1000 mw each nuclear power plants to be located in southern tip of Tamil Nadu, Dr Srinivasan said that this was needed to meet the power shortage which would still be there at the end of the coming decade despite our own thermal and nuclear power programme.

The safeguards accompanying the Soviet offer "do not in any way take away our self-reliance" as it would be in addition to what we were doing, he contended.

The Russian reactors we were getting were "different from the types at Chernobyl" one of which blew its top two years ago. Dr Srinivasan explained that the reactors would be pressurised light water reactors (PWR) and would not have the graphite moderator of the Chernobyl type.

"The safety standards will be ours," the DAE chief emphasised and "our own safety people would be using it." "If required, additional features would be incorporated," he added.

This correspondent, however, learns that there is a great deal of apprehension among Indian nuclear scientists on the Government decision. Many top people believe this to have been a political one. Dr Raja Ramanna had opposed the acceptance of the offer. His predecessor Dr H. N. Sethna was also not interested in it.

In a strong defence of nuclear power, Dr Srinivasan insisted that our reactors had been built on the principle of "fail safe." This correspondent, for instance, saw in the Dhruva reactor at Trombay the fail safe system at work of how neutron absorbing cadmium rods would drop into the fuel core within one second of an anomaly building up. Further, how a pressure build up would be automatically eased through a fall in the level of water in which the reactor is kept. Even if the operators are all sleeping, the reactor system would stop dead within a few seconds of any anomaly building up," Dhruva operating superintendent Veraraghavan explained.

Dr Srinivasan also refuted that there were doubts in any segment of Government over the capacity of the DAE to reach the 10,000 mw target for nuclear power by the turn of the century. "I have seen no such doubt anywhere in any branch of the Government," he insisted. We have a high level of confidence that the Nuclear Power Corporation would reach the target. He said "real improvements would be seen very soon both in regard to planning and execution and gestation period will be reduced."

Projecting an optimistic scenario for nuclear power in the 21st century, the Atomic Energy Commission Chairman said that worldwide the share of nuclear power would go up to 30 to 40 percent of the total energy output in the first few decades of that century. The present level is 16 percent.

Energy planning in each country would have to follow its resource position and distribution but even in the well and widely endowed country like United States, there were already 100 nuclear reactors working. In Soviet Union where fossil resources were concentrated in far off Siberia, nuclear power was being pursued. In France where there was hardly any fossil fuel, 25 to 30 percent of primary energy was from nuclear sources at present and was going to be 75 percent soon. Japan was also moving ahead.

To those who were raising fears of ecological and environmental dangers from nuclear power, Dr Srinivasan asked whether coal based power plants were any safer. Apart from environmental dangers of coal dust, fly ash and largescale mining, coal for us was required as fuel for furnaces and domestic cooking to replace precious wood. In areas far from coal fields, "Nuclear energy is the

economic alternative" with solar and wind energy still being not economic for large-scale use. With a power shortage already at our doorstep, to deny ourselves nuclear energy would be to accept the fact that "we will not be able to supply energy in future even to the extent we do today," the Commission Chairman asserted.

"It is in this context that nuclear power is relevant," Dr Srinivasan who had earlier overseen the setting up of nuclear power reactors at five different locations, said. A few minutes before this interview, he had given the go ahead signal for work on the Kaiga atomic power plant in Karnataka, the sixth India is building in a series of 12 such plants to come up in the next 12 years. "The sites for the new plants would be soon announced," he said.

Official Discusses Prototype Breeder Reactor
BK1108081988 Delhi Domestic Service in English
0730 GMT 11 Aug 88

[Text] The government proposes to build a 500-megawatt prototype fast breeder reactor by 2000 AD. The minister of state for science and technology, Mr K. R. Narayanan, told the Rajya Sabha today during question time that a number of such reactors will be constructed after the successful commissioning of this reactor. Answering supplementaries, he said fuel for these reactors will be obtained by reprocessing irradiated uranium discharged from the pressurized heavy water reactors and by recovering plutonium bred in the fast breeder reactor itself.

Plan To Install Nuclear Reactors Revealed
BK2808094988 Delhi Domestic Service in English
0830 GMT 28 Aug 88

[Text] The Nuclear Power Corporation has drawn up an ambitious plan of installing a series of atomic power reactors to meet the 10,000 megawatt target by the turn of the century. These include 12 pressurized heavy water reactor units of 500 megawatt each. The managing director of the corporation told our correspondent that the construction work is in full swing at Narora and Kakrapar projects. He said the work is to begin soon at Kaiga in Karnataka and on another two units of the Rajasthan Plant.

Dangers of Pakistan Nuclear Arming Examined
51500224 New Delhi PATRIOT in English 8 Jul 88 p 4

[Article by Cecil Victor: "Pak Nuclear Programme and India's Response"; passage in italics as published]

[Text] A new phase in the Indo-Pak nuclear imbroglio has begun: the timing of the unveiling of the subcontinental nuclear arsenal. That the revelation has dynamics of its own is obvious because on it will depend a whole series of formulations for defence in both Pakistan and India. Already the first salvo has been fired by the expose

by an American magazine that Pakistan has manufactured four 400-lb nuclear bombs capable of being delivered by its F-16s on Indian targets identified a few months earlier by another journalist working for a western newspaper.

The first article reporting the testing of a missile by Pakistan indicated that its range was long enough to bring Delhi and Bombay under attack. The more recent magazine article is meant to convey that with the help of China, Pakistan had mastered the techniques of miniaturisation to be able to make 400-lb nuclear bombs which can be carried like ordinary ordnance on underwing pylons of the F-16s, Mirages and the Chinese-built Fantan jets in the Pakistani inventory. In conjunction the two articles are meant to elicit a response from India: what will it do to counter the now overt Pakistani nuclear threat?

That is the crux of the emerging nuclear arms race on the subcontinent. If India reacts by announcing that it will counter these developments by exercising its nuclear option and manufacturing its own nuclear arsenal *that* will become the reason for a "legitimate" overt Pakistani nuclear weapons programme which will be proclaimed to be in response to India going nuclear. That these reports are based on the CIA's appreciation of the Pakistani nuclear weapons programme is significant because the Reagan administration has year after year been giving the Ziaul Haq regime a clean chit to be able to waive the Symington amendment which bans the supply of conventional weaponry to any country which is engaged in making nuclear weapons.

The U.S. has long been trying to lay the onus of nuclear non-proliferation on India through its policy of arranging a bilateral non-proliferation treaty between India and Pakistan as the method of preventing Pakistan from going nuclear. It is so patently dishonest that the Government of India had no option but to reject it out of hand.

It is for this reason that both the U.S. and Pakistan are using the media to set the tempo. For India the dilemma is fast approaching whether it should exercise the nuclear option or take other measures to ensure that the strategic balance does not become irrevocably tilted against this country. The transition in Pakistan from being "two screwdriver turns away" from making a nuclear bomb to being able to deliver it on target would open up a whole new scenario for India.

The most likely would be escalation in the capacity to use coercive diplomacy most particularly in its current campaign to create a Khalistan in Punjab. With atom bombs in its arsenal the Pak military dictatorship will be more adventurous in its support to the Sikh secessionists thereby putting greater pressure on the Indian security forces. As a corollary the activities of the Pak military along the line of actual control in Jammu and Kashmir will also increase with the intention of harassing Indian

troops and tying them down to prevent their redeployment. More strenuous efforts will be made to take the Siachen Glacier (if the Government of India does not, in the meantime, do what Pakistan, China and the U.S. want it to do—agree to the extension of the line of actual control beyond Grid Reference NJ 9842).

This scenario in its bits and in its totality becomes credible in the background of information percolating from prospective enemies that the Indian armed forces are "tired," "overstretched" and "bereft of reserves" because of deployment in Sri Lanka. If the enemy has such an impression of Indian troops then backed with nuclear arms an adventure against India becomes all the more probable.

In any case, long before it has actually manufactured nuclear weapons Pakistan has attained many of its foreign policy objectives by a systematic use of coercive diplomacy and tactically appropriate moments when it shouted "wolf" and prevented what was from the Indian point of view of territorial integrity and preservation of national interests necessary at that point of time. It has prevented us (with a little help from Casper Weinberger and Frank Carlucci, successive U.S. Defence Secretaries) from implementing a policy of hot pursuit which would have brought a swifter end to the terrorist problem in Punjab. It has also, by that same method, stopped us from taking what would, militarily, have been the more appropriate response to the frequent attacks on our pickets in Siachen. We have, actually, been brought back to the negotiating table in an attempt to legitimise its illegal occupation of Kashmir. All this without the bomb. When it does eventually decide to announce to the world that it has the bomb what should India do? In any event it is imperative to avoid a knee-jerk reaction. We do not need a bomb in a hurry but we do need credible conventional forces that are capable of defending national interest swiftly and clear-headedly.

Before we can make even the bomb a credible deterrent we have to accomplish several things. The first of these is the successful completion of the Sri Lanka campaign and that means a swift neutralisation of the LTTE militarily and forcing it into mainstream politics. Any half measures there will not be able to redeem India's image and her capacity to discourage nibbling at her periphery by all and sundry.

Next, there has to be a revamping of our security forces—the entire lot and not just the Army, Navy and Air Force to be able to both execute conventional battlefield tactics in a swift-moving war and at the same time handle a situation of multiple insurgencies backed by infiltrations and weapons support from across our borders. This implies that the BSF, the CRPF and local police forces have to be so restructured and re-equipped that the rear base of our military effort is both secure and productive in support of the war effort. We must, in short, be prepared to handle both wars (may be two simultaneously) across our borders and foreign-inspired

guerilla warfare within the country lest it is brought more forcefully home (than it has done in Sri Lanka) that we have actually prepared for the wrong war.

It is no secret to our enemies that Indian armed forces were unable to take appropriate measures at appropriate moments primarily because of the insurgency in Punjab and the threat it posed to the lines of communications. Gen Sunderji's massive airlift notwithstanding we are today as vulnerable to infiltrationist tactics as we were in 1965. Do we have to ask the infiltrator: "Can I come across in hot pursuit?" Of course he will say no.

The point is that a nuclear arsenal could become an embarrassment to India if it is unable to muster the political will to use the conventional forces at its command to advantage. And the conventional forces should be able to deliver the goods without saying we never thought it would be like this.

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Need for India To Have Nuclear Submarine Examined

51500222 Madras *THE HINDU* in English
14 Jul 88 p 9

[Passages in boldface as published]

[Text] New Delhi, July 13. The report in the Pakistani newspaper JANG citing an interview of the American Ambassador to Islamabad, Mr. Arnold Raphael that the Reagan Administration has requested Congress to allow the sale of nuclear-propelled submarines to Pakistan has created a sense of unease in New Delhi. The U.S. decision would have serious implications for Indian security planning.

India has been aware of the opposition of the U.S. to the acquisition of the INS Chakra, an old Charlie-I class nuclear-propelled submarine. However, the U.S. authorities was clearly informed that the submarine was merely for training purposes and that it carried no nuclear armament. India had also assured Washington that no additional submarines were to be acquired in the near future. In fact, U.S. officials had by-and-large accepted the Indian explanations and Pakistan had, therefore, begun looking for other options including a untested hybrid engine featuring a diesel-electric engine combined with a sort of a nuclear power-pack which a Canadian company claimed could be retrofitted into conventional submarines. In this context, the statement from Mr. Raphael, a seasoned career diplomat is strange.

20-year programme: Indian Navy planners have for quite some time planned to induct nuclear submarines into their inventory. For the past two decades there have been research programmes to build a nuclear reactor capable

of propelling a submarine. The first programme was run out of the Bhaba Atomic Research Centre near Bombay but this failed to achieve the necessary results.

However, there were other obstacles besides the reactor programme, the main one being the inability to design a suitable hull for a submarine. Partly for this reason, the country went in for the HDW submarine deal whereby the company would build two submarines at the Mazgaon Docks in Bombay. The experience has convinced many that there is quite some way to go before the country can master the skills of building a submarine hull, especially one capable of carrying a nuclear reactor.

The reactor design is now being undertaken by the Advanced Technology Vessel (ATV) programme of the Defence Research and Development Organisation. Considerable success has been made, but India has at least half-a-decade to go before it can match the reactor and hull to make a regular nuclear-powered submarine.

For training purposes: Some time in the early 1980s, when the ATV programme really got under way, India requested the USSR to provide a nuclear submarine to India for training purposes and to permit the Indian Navy to get a 'hands-on' experience in running such a vessel. That finally materialised earlier this year when the Chakra was inducted into the Indian Navy.

Mr. Raphael's hope that the Reagan Administration's request for the sale of the 'latest nuclear submarines' to Pakistan will be cleared by Congress is now likely to touch off a debate within the Navy as to whether it could wait for an indigenous vessel or go in for quick imports from the USSR. There is a problem here. It is not quite clear that the USSR which is a stiff advocate of nuclear non-proliferation will oblige India with a contemporary nuclear propelled submarine that will be equipped with a matching weapons systems.

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U.S. Expert Interviewed on South Asian Nuclear Arming

51500223 Bombay *THE TIMES OF INDIA* in English
11 Jul 88 p 18

[Article by Dilip Mukherjee: "South Asia's N-bombs Not Operational Yet"]

[Text] With NEWSWEEK citing intelligence sources to claim that both India and Pakistan have now nuclear bombs in their basement, the sub-continent is reminded once more of the danger of an Armageddon.

An independent American expert, who has been watching the situation closely, says he can neither confirm nor refute the claim, but he sees no evidence of either country having taken any step to "operationalise" nuclear weapons.

The fact that both countries have undoubtedly acquired the capability to build an arsenal creates a situation to grave uncertainty.

"My fear is that the current situation of a developed, but not operational, nuclear capability would not last. Elements in the military in both countries would begin to fear that the other side has one ahead and begin to operationalise to avoid being taken by surprise. Pressures will mount to go down this road," he said.

Mr Leonard Spector, who has been compiling for the last three years an annual report for the Carnegie Endowment for International Peace on the nuclear scene in the threshold countries, collects pertinent information from public sources all over the world, and is in also touch with the U.S. policy-makers and its intelligence community.

He was in New Delhi with three other colleagues of a 18-member American task force, assembled by the Carnegie Endowment which produced a report last December recommending nuclear restraints for the sub-continent. They met the Prime Minister, Mr Rajiv Gandhi, last Monday.

Mr Spector answers the following questions regarding the sub-continent.

Q: Does India now have bombs ready to deploy?

A: The situation is ambiguous. The U.S. administration has told me on several occasions that India does not have a stockpile. The plutonium is of course, there, as also the knowledge to convert it into bombs. Work has surely continued on refining bomb design, but there is no hard evidence. If you ask whether there is a programme for the production of nuclear weapons, the answer is no—as the administration has told Congress.

Some think otherwise. A story circulated earlier this year by (the American news agency) the UPI claimed, possibly on the basis of information from the (U.S.) defence intelligence agency, that India was building at the rate of 20 bombs a year, and work was in hand to miniaturise the warhead to permit fitting to a missile. I checked with knowledgeable persons in the administration and Congress, and was told that this wasn't true.

Q: What do you think is in Pakistan's basement?

A: A recent article in the NEW YORK TIMES magazine cites a special national intelligence estimate drawn up by the U.S. administration to say that weapons grade uranium first became available from Kahuta in mid-1986. The article said that enough had been accumulated by early this year for four to six explosive devices. This is in line with the estimates made by me and my colleagues.

Delivery Capabilities

Q: Do you see any signs of work on delivery capabilities?

A: Apart from a UPI story that Indian Jaguars were engaged in practice runs, issued about the same time as the one I referred to earlier, I have heard of no new developments on either side of the border. Practice runs would indeed be necessary because dropping a nuclear bomb calls for a special procedure. After zeroing in on the target area, the aircraft must be into a steep climb immediately after releasing the bomb and turn sharply backwards to escape the after effect of the blast.

This being the case, a country planning to use bombers for a nuclear strike would have to set apart men and machines for this purpose. Pilots will have to be selected for skills and political reliability. The earmarked aircraft will have to be segregated and specially protected. A special chain of command will have to be created between the ultimate political authority and the designated unit. Training will require dummy bombs exactly duplicating the size, shape and weight distribution of the nuclear device. It is doubtful all this can be kept secret from the several intelligence agencies which are undoubtedly looking out for tell-tale signs.

Operational Arsenal

This suggests that neither India nor Pakistan has yet moved to the stage of putting nuclear devices into operational arsenals—unlike Israel which has certainly induced nuclear weaponry into its armed forces. I would be surprised to find any Indian or Pakistani military personnel playing at this stage any role in nuclear preparations.

I am assuming that the nuclear establishment in both countries works directly under the top political authorities. So far they are the only ones involved.

Q: The deputy assistant secretary, Mr Robert Peck, told some correspondents here that the U.S. administration had concluded that Pakistan did not have a delivery capability because the F-16 it might want to use would have to have its bomb release system specially modified for the purpose. This is something that Pakistan is not capable of doing on its own, and Washington is taking good care to ensure that Islamabad gets no help from outside. Indian experts say that it is ridiculous to argue that refiguring the release system is beyond Pakistan's capability. What is your view?

A: I am not crystal clear on this. There may be computer snags to overcome because both the acquisition of a target and the release of a bomb to hit it are done by a F-16 pilot with automated devices involving computerised software. It is possible that the complex manoeuvre for dropping a nuclear bomb requires rewriting the software. This may be beyond Pakistan, but your air

force people would have the experience to make an informed judgment. To my mind, modifying the aircraft in a rudimentary fashion should not be too difficult.

Secret Acquisitions

Q: Are clandestine acquisitions of sensitive nuclear materials by Pakistan continuing?

A: In the wake of the smuggling from the U.S. that came to light in late 1986, the administration justified granting a waiver from the cut-off of aid as the law requires on the basis of assurances that such activities within the U.S. would cease. Officials said they had evidence that some activities had indeed stopped. In any case, the administration conceded the acquisition network was operating internationally. One can only hope that other governments are being adequately vigilant. Some information has recently surfaced of the use made by Pakistan of Turkish intermediaries over the years.

Q: In the wake of the successful Indian test of a 250 km surface-to-surface missile, there have been several reports of Pakistan developing missiles of its own, and of one test over a 500 km range. Both the Indian and the U.S. agencies do not give any credence to reports of testing. How do you see the situation?

A: People in the U.S. are worried about the possibility of Pakistan acquiring the Chinese M-9 missile which has a range of 600 km. China has been showing it at air shows, which makes it reasonable to assume a readiness to sell as soon as the plants can deliver. This is a missile ready to be deployed. I am not saying that a sale to Pakistan is in the offing, but that this is something to watch out for in view of the arms supply relationship that already exists between the two countries.

Q: Do you know of any signs suggesting that the Indian or Pakistani armed forces are making changes in their doctrine to allow for the use of or defence against, a nuclear strike?

A: All I can say is that the situation is changing. Your former army chief, Gen. Sundarji, had written—was it in 1981? That the pattern of the troops deployment would have to change to deny the adversary's massed targets. It may take quite a while to put new concepts into practice, but that will happen since the military in both countries know full well the impact nuclear weapons will have on operations.

Q: What is your reaction to the proposals put forward by the Prime Minister, Mr Rajiv Gandhi, for nuclear disarmament by the superpowers and the other three nuclear weapon states, accompanied by a binding commitment by threshold countries not to cross the threshold?

Richer Version

A: This is a richer version of the existing elements of Indian policy. I am not denigrating it, but I am afraid that the scheme requires so much to happen globally before the regional danger is addressed. This would dangerously delay attention to India's most important security concerns. The proposal represents only one part of the India response to the regional challenge. The other is the approach to Pakistan on a bilateral basis including the important offer of a pact not to attack each other's nuclear facilities. Tensions over Punjab have stalled the dialogue, but it needs to be pursued when frictions ease a bit. Both sides have expressed interest in confidence-building measures which I am sure will have a nuclear component.

Q: In the improved climate of international relations following the superpower agreement to eliminate one class of nuclear weapons, do you see a better prospect for halting nuclear proliferation?

A: Yes, I do. A proposal like that made by (air commodore) Jasjit Singh, Director of the institute of defence studies and analysis for the elimination from the Asian landmass of all nuclear weapons, other than the strategic ones, gains added legitimacy.

Q: What do you think of the proposal made by Mr K. Subrahmanyam former ISDA director, for a binding declaration by India, Pakistan, China and the Soviet Union against the first use of nuclear weapons?

A: It may be a useful confidence-building measure, but it can't be taken as an iron-clad guarantee of nuclear safety. Besides, I have misgivings that a commitment against first use implicitly legitimises nuclear deterrence. At this stage when nuclear weapons are still to be operationalised to the subcontinent, this will be a step backward. Moreover, India may be better off with the categorical Chinese pledge never to use nuclear weapons against a non-nuclear power. An agreement against first use would weaken this blanket commitments.

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PAKISTAN

Nuclear Energy Self-Sufficiency Plan Prepared
BK0908113488 Islamabad Domestic Service in English
1100 GMT 9 Aug 88

[Excerpt] During question hour [in the Senate today], the house was informed that Pakistan has drawn up a comprehensive plan of action for indigenization of its nuclear program to achieve self-reliance to meet its needs for nuclear energy. The minister for justice pointed out that foreign countries were not willing to supply nuclear plants to Pakistan on political grounds

insisting that it should first sign the Nuclear Nonproliferation Treaty. He reiterated Pakistan's stand not to do so unilaterally till India also signs the treaty.

Plan for Nuclear Self-Reliance Developed

*BK1708142188 Islamabad Domestic Service in English
1100 GMT 17 Aug 88*

[Text] Pakistan Atomic Energy Commission has developed a comprehensive plan of action aimed at achieving maximum self-reliance in the field of nuclear power as quickly as possible. APP [ASSOCIATED PRESS OF PAKISTAN], quoting official sources in Islamabad, says

the commission has already acquired essential technology for the exploration of uranium resources and other materials, production of uranium concentrate and oxide, and manufacture of nuclear fuel elements ready to be used in power reactors.

At the same time, it has been decided to undertake the development of necessary infrastructure for designing and manufacturing a large number of other facilities for nuclear power generation. According to sources, Pakistan will need several nuclear plants to bridge the gap between power demand and supply over the next 15 years.

FEDERAL REPUBLIC OF GERMANY

Inattention to Nuclear Terrorism Threat in FRG Scored

51002453 Bonn ZIVILVERTEIDIGUNG in German; Parts I, II, No 1, 1988 pp 10-16; Parts III, IV, No 2, 1988 pp 5-11

[Article by Alexander Rosnagel: "Nuclear Terrorism: Motives and Strategies in the Light of the Latest International Discussion"]

[Box] After the reactor failure in Chernobyl, there was a great deal of talk about technical and human failure in the area of the civilian utilization of nuclear energy and about its consequences for the life and health of millions. More than 30 people had to die so far in Chernobyl, thousands to tens of thousands will contract cancer, and hundreds of thousands were driven from their homeland. If negligent or even correct human actions in the case of technical failures can cause catastrophes of such a magnitude, then how much greater could the damage be if people consciously and maliciously seek to exploit the nuclear damage potential for their purposes. The full risk of catastrophe from nuclear energy is grasped only when the dangers of nuclear terrorism are considered. In the FRG, however, there is little inclination to do this. Whereas in the U.S., for example, the risk of the unpeaceful use of nuclear energy is being discussed seriously and on a broad scientific basis, this risk of nuclear technology is largely suppressed here. In the following, however, on the basis of the latest American investigations and the previous experiences with nuclear terrorist actions, an attempt is to be made to obtain a more realistic picture of future risks of nuclear terrorism than is generally seen.

[Text]

I. Different Assessments

Official voices spread confidence. The danger of the unpeaceful use of nuclear energy [it is said] is overstated. The cases known to date give no reason for serious fears. Nuclear power plants are "not very suitable targets" for terrorists and other malevolent persons. For one thing, they would be deterred by the high degree of safety and security. In addition, such attacks do not fit into the terrorist ideology and, thirdly, they could more easily achieve such destructive acts—if they should decide on them—with nonnuclear means. In the future, accordingly, one should expect only attacks at a low level, for the defense of which the existing security measures are adequate.¹

A somewhat different picture of the future is revealed when one introduces the arguments and results of the latest American discussion of the danger of the misuse of nuclear energy.² It is recommended for three reasons that American expertise be made to bear fruit for the German discussion as well. In the first place, in the U.S.,

in contrast to the FRG, the risks of the unpeaceful use of nuclear energy are being researched extensively. To name just two examples: for years the Rand Corporation has been carrying out a research program on the threat to American nuclear installations on behalf of different U.S. Government agencies. And in 1986, the Nuclear Control Institute in Washington undertook an International Task Force on the Prevention of Nuclear Terrorism, in which 26 scientists from 9 countries participated.³ Secondly, there is extensive discussion of the question of the risks of nuclear misuse. Such international conferences are taking place on this subject, as, for example, the Conference on International Terrorism: The Nuclear Dimension in June 1985.⁴ Thirdly, the American research is free from the suspicion that its results are based on prejudices against or consideration for the German nuclear industry.

The optimism of the German assessments is essentially based on two themes, namely, that there are no motives for nuclear terrorism and no feasible strategies for nuclear terrorism. In the following, these two themes are to be examined on the basis of the latest American research as well as previous experience.

Nuclear terrorism should thereby be understood as the illegal use of force with the help of nuclear weapons or against nuclear facilities and transport so as to spread fear and alarm.⁵ Here we are not considering the closely linked problems of the diversion of nuclear material and of a nuclear black market.⁶ To be sure, the procurement of material suitable for weapons is an important preparation for the use or the threatened use of nuclear weapons. Here, however, only those actions are to be examined that can lead directly to great catastrophes.

The following comments remain limited to the motives and possibilities of subnational groups. To be sure, states have motives and definitely have possibilities for carrying out acts of nuclear terrorism, as the attacks of Iranian and Israeli bombers against Iraqi and of Iraqi jets against Iranian nuclear power plants show.⁷ If it turns out, however, that a substantial risk can result even from subnational groups, then this will certainly apply to states. It should be considered, however, that subnational groups can receive support from states. Meanwhile, many states have recognized terrorism as a useful instrument of concealed influence or warfare. But state assistance improves the preconditions for terrorist actions: information, logistics, money, the latest weapons, and scientific-technical support lower the action thresholds and make it possible to operate at a higher level of force.⁸

II. Motives

Only 3 percent of the radioactive stock was released at Chernobyl. A substantially greater damage potential could be activated through purposeful actions. How probable is it that someone strives for such catastrophic results? No one can answer this question unequivocally. There is neither an automatism of escalating terrorist

force to the point of the detonation of an atomic bomb nor can we preclude the possibility of not finding out about the step toward nuclear mass murder until after the fact. It is at best possible to draw some cautious conclusions on the narrow basis of what we know about the determining factors of such actions.¹⁰

The technical problems can be overcome. Many people possess the necessary abilities. The relevant literature is widely available. The necessary basic materials can be freely obtained or stolen and the required weapons can be acquired in the black market.¹¹ The knowledge and the material for the production of a nuclear device are becoming more and more widespread. Even if the way from the design to the production of a nuclear device is quite long, the probability that a subnational group will also succeed in such a project is becoming greater and greater, especially if it is supported by a state.¹² The greatest difficulty may well be in obtaining plutonium or highly enriched uranium as the raw material of the bomb.

The plutonium produced in power reactors is also suitable for bombs. There can no longer be any doubts about this after the U.S. successfully tested a bomb with reactor plutonium in 1977.¹³ In the summer of 1986, on behalf of the International Task Force on the Prevention of Nuclear Terrorism, five experts on nuclear weapons investigated whether a small group would be able to make a bomb from it. They came to the conclusion that this is difficult, to be sure, but that just three or four people with the relevant experience and knowledge could build a simple and not especially effective atomic bomb.¹⁴ If they were to get hold of reactor plutonium, then they could utilize the plutonium oxide unchanged, whereby, by building in a neutron reflector, they would need a quantity of more than 17.5 kg. But they could also transform the plutonium oxide into plutonium metal within a few weeks. It would then be possible for them to build a warhead with just 5 kg of plutonium metal. It could then develop an explosive force of up to 10 kilotons.¹⁵ If they were supported by a state, then the difficulties are reduced substantially and the possibilities of success are increased greatly.¹⁶

The level of terrorist force has heretofore often remained below the technical capabilities and possibilities of the groups involved.¹⁷ Some of them may now already have the capabilities of carrying out nuclear actions. In the past, however, they have hardly utilized this possibility.¹⁸ Thus it appears that there are self-imposed upper limits for the application of terrorist force. The most important hindrances are thereby not so much the technical difficulties but the political cost-benefit considerations and moral and ideological scruples still in effect.¹⁹ Through the scientific-technical changes, on the other hand, more and more resources are becoming available to smaller and smaller groups to carry out mass murder, to take industrial societies hostage, or to attack targets that were formerly invincible by them. Is it not

possible that in the future, with the greater possibilities and the increasing facility of carrying out such acts, the inhibitions for the use of such resources could diminish?²⁰

Mass murder has heretofore been infrequent and was probably seen as harmful by most terrorist groups. Most of the groups now known are fighting for goals that they want to present to their reference group as rational. At least in the case of terror not guided by the state and above all for groups operating within the borders of their country, the reluctance to sacrifice many innocent people and thus to lose sympathy for their own cause may well preclude mass murder as a means of terror.²¹ For many—above all “leftist”—terrorists, mass murder is immoral. Their enemies are the governments that they oppose and not innocent victims among the population. Willful mass murder would violate their own self-understanding and endanger the image that they want to present to the public.²²

Jenkins rightfully points out that mass murder really does not correspond very well to the political calculations of terrorists. They do not want to kill a lot of people but to get their attention and approval for their intentions.²³ The threat itself of bringing about the death of many people through a single attack could under some circumstances help to achieve this goal but its execution would not.²⁴ To cause the death of many people can therefore be slightly counterproductive politically: the abhorrence over this crime can wipe out all sympathy for the cause in the target group of the terrorists and lead to an alienation of the group from their supporters and sympathizers. The violence of a successful nuclear action will greatly exceed the usual magnitude of criminality and terrorism or at least be perceived that way. To counter the insecurity or even unrest in the population, the state would have to react with extraordinary harshness. The intensive antiterrorism efforts of the state could then overtax the power of resistance of the terrorist group and lead to its extinction. To the extent that the group can be attributed to a particular social force, these efforts would involve more or less open state retaliatory actions. Through the overall political climate that it creates, the nuclear action will likely do more to strengthen than to weaken the forces that the group wants to combat.²⁵

These considerations apply to a large number of political constellations and motivational structures today. Unfortunately, however, they are very abstract and do not cover all cases of terrorist strategy planning possible in the future or historically derivable. In the past, certainly, terrorists have largely limited themselves to bombing attacks and to the taking of hostages. Their actions have seldom resulted in more than 20 deaths.²⁶

There are, however, exceptions such as, for example, the killing of about 700 people in the attack against a theater in Teheran in the fall of 1978, for which a group loyal to the Shah was suspected; the bombing attack by rightwing

terrorists in the main railroad station in Bologna, where 85 were killed and more than 200 injured; the explosion of a truck bomb in Teheran in October 1982, which killed 60 people and injured more than 750; the kamikaze actions by Shiites first against the U.S. Embassy in Beirut on 18 April 1983, which cost 63 lives, and then against the headquarters of the U.S. Marines and the French paratroopers in Beirut on 23 October 1983, to which a total of 281 people fell victim; a bombing attack of the Unita in the Angolan city of Huambo on 19 April 1984 that killed more than 100 people; the bombing of the Air India jumbo jet during its flight from Toronto to London, through which presumably Sikh extremists killed all 329 on board in June 1985; and many other examples.²⁷ Altogether it can be said that terrorist attacks have increased in the last 20 years, both in their number and in the number of deaths.²⁸

Thus, it cannot be stated that the history of terrorism is generally characterized by scruples and inhibitions about carrying out mass murder. In view of the catastrophic consequences, no one responsible for the safety of citizens or employees will count on them. Terrorist groups and state agents have already carried out nuclear actions, in which one could not rule out the possibility that they might also cause major damage. Previous experience shows that the catastrophic consequences of a nuclear terrorism are at least conditionally accepted by the perpetrators.²⁹

The unpeaceful use of nuclear energy would be just as unproductive for terrorists as for states with nuclear weapons. It is overkill in both cases. But for neither can it be ruled out that they will make use of the destructive power of nuclear energy.³⁰ This may well be more to be feared from subnational groups, because nuclear retaliation is not possible against them and nuclear deterrence is of no effect.³¹

There is no guarantee that future groups that use terrorist tactics will observe the self-imposed limits as in the past.³² The self-limitation has heretofore been the main reason for the relatively small number of victims of terrorism compared with the possible results of an unlimited use of nuclear power by terrorists. On the contrary, a number of reasons that are relevant for the development of modern-day terrorism—each for itself or several taken together—make the increase in nuclear terrorism seem rather more likely.³³

1. Symbolic Upgrading

The atomic bomb is the symbol of power in our time. The vision of being able to exercise authority through the detonation of an atomic bomb—authority that the world's most powerful states have heretofore been able to reserve for themselves—and thus to stand up to the ruling powers, must be fascinating to every subnational group that wants to achieve its political objectives with the means of terrorism. This charisma of the atomic bomb makes it fundamentally different from all other

means of mass destruction that would be available to subnational groups and explains a special attractiveness of actions that lead to the building of such a device or make possible a threat to use it.

The possession of an atomic bomb or the takeover of a nuclear power plant would ensure the group quasi-state recognition. It would also "sit at the table" of the nuclear powers. Terrorist control over nuclear power would dramatically change the domestic political and possibly the foreign political distribution of forces as well. The threat of a nuclear catastrophe could force even nuclear superpowers to give in to the demands reinforced by nuclear power.³⁴

Precisely because many terrorist groups behave like states and want to be feared and treated like equal adversaries, the model of the states in handling nuclear energy may greatly influence their future development. In particular the current concept of nuclear deterrence could do much to stimulate subnational groups to proceed just as the superpowers. Their missiles are aimed at the adversary's cities. They reciprocally hold their population and that of their allies hostage so as to deter the other side from a nuclear first strike. This strategy is credible only because the nuclear powers daily demonstrate their unconditional willingness to commit nuclear mass murder. Anyone who wants to compete with them must likewise possess this capability and willingness and, to be credible, demonstrate it.³⁵

2. Means of Coercion

This leads to an additional incentive for the unpeaceful use of nuclear power. It gives subnational groups a previously unachievable power to force their demands on the embattled state. No other terrorist action would cause comparable physical damage, a greater psychological shock and greater political unrest than the detonation of an atomic bomb.³⁶ The credible threat alone puts any government in a hopeless situation: it could neither risk the lives of its citizens nor allow its policy guidelines to be prescribed by blackmailers. The possibility of taking large parts of the population hostage would significantly improve their bargaining position. More powerful means permit them to pursue higher objectives or to implement existing goals more directly and more quickly.³⁷

No other action than nuclear could so effectively put into question the power monopoly of the state, present the government as so helpless and do so much to shake the population's confidence in the ability of the state to protect it. "Bommi" Baumann, the former member of the "Movement 2 June," states: "Anyone holding something like this in his hand can make the federal chancellor dance the cancan on the table on television—and some other statesmen along with him. That is a permanent change."³⁸

3. Publicity

Terrorism is propaganda through action. It is a form of psychological warfare. The action serves as a media event to convey political interests. An attack, be it ever so successful, that no one notices remains without further consequences and thus ineffective. "The act of terror in itself is nothing; publicity is everything."³⁹ In view of the flood of information, the necessity of repeatedly having to gain public attention compels escalation and could easily induce one to carry out the most spectacular actions possible having the odor of the mystical that spread fright and dismay.⁴⁰

Probably even more than by the destructive effect of nuclear actions, therefore, terrorists are attracted by the worldwide attention that such actions achieve through their nuclear horror. The words "atomic" or "nuclear" remind one of Hiroshima, not Gerdremmingen. The high signal value of nuclear energy would ensure such actions first place in the media. They would create the sudden dramatic effect that the media cannot resist. It would be the first and historic step into a new era of violence. The theoretical possibility, feared or suppressed and the subject of countless novels, would become reality.

It would be an excellent means of attracting worldwide attention to the group and its political demands. Even a credible threat would probably be sufficient to achieve this goal. It would not even be necessary to carry out the action. Even if it is more difficult to utilize nuclear means than other means that are equally effective from a purely instrumental point of view, terrorists could resort to them because they know the general fascination and fear that global publicity guarantees them.⁴¹

In the past, the great fascination with the "nuclear" was exploited, for example, by the "Revolutionary People's Army," which on 25 March 1973 attacked the almost completed Argentine nuclear power plant Atucha with a heavily armed detachment, destroyed parts of the facility and withdrew in an orderly manner,⁴² or by the armed branch of the "African National Congress," which was able to detonate four bombs at intervals of 4 hours in the nuclear power plant Koeberg near Capetown.⁴³

4. Arms Race

The permanent arms race between security forces and terrorists could ultimately force the latter to resort to more powerful resources if those heretofore used no longer lead to success. This escalation of violence must not necessarily lead to nuclear terror. There are still other possibilities for increasing force below this level of violence. The more successful the state security forces are in combatting terrorism, the more probable it is, however, that the unsuccessful group may be willing to resort to the all-decisive weapon, to the extent that it still can.⁴⁴ Just as states consider the use of nuclear weapons justified under certain circumstances and threaten other

states with them, terror groups could also see themselves as forced and justified to use materials and facilities of the peaceful utilization of nuclear power as a weapon. The forced violence thus achieved could protect the group and its surroundings against further state deterrent or retaliatory measures and give it back the offensive with the possibility of putting through its demands.⁴⁵

This motive can probably be found, for example, in the plans of the Red Brigades at the end of the 1970's to attack nuclear power plants in Italy or of militant Sikhs in 1985 to attack and destroy Indian nuclear power plants with the support of Pakistan, among others.⁴⁶

In World War II, zone bombing that also hit the civilian population was undertaken by all sides. And in most of the wars waged since then, the civilian population suffered the most. Why should not the inhibitions of "warning" terrorists not decline just as they do for states at war? Many terrorist groups see themselves at war with the superpowers or a military alliance. This could make a nuclear "counterstrike" against military facilities appear necessary, in which victims in the civilian population would also have to be accepted as unavoidable "collateral damage."⁴⁷

5. Despair/Revenge

Also linked with the increasing successes of state antiterrorist actions is the fear that a thoroughly desperate group might see a catastrophic action as the last way out. The feeling of not having anything to lose would serve to diminish the inhibitions and scruples against a nuclear action and to provide the motive for a nuclear "twilight of the gods." Precisely the downfall of a terrorist group and the failure of its previous conventional strategy could lead to such despair and squabbling that a radicalized minority determined to undertake nuclear actions will take control over the entire group or will break away from it so as to counteract the failure of the original strategy through greater militancy and bloodier acts of violence.⁴⁸

The hatred of the oppressors or the desire to avenge one's own losses—as in the case of the attack against the nuclear power plant Koeberg⁴⁹ or in the case of the threat of an Armenian group to detonate three nuclear devices in major Turkish cities to retaliate for the Turkish genocide of the Armenians⁵⁰—could facilitate this decision. The enemy is supposed to see how much what he himself does hurts. A nuclear counterattack could appear to be justified, especially when he actually or supposedly commits genocide.⁵¹

6. Existential Differences

The self-imposed restraints could be diminished if the perpetrators and victims belong to different ethical and religious groups such as, for example, the named Armenians and Sikhs or the "Armed Forces for the National Liberation of Puerto Rico" that in 1975 threatened to

detonate atomic bombs in the U.S.⁵² Historically the fight against barbarians, heathen or unbelievers has often had to justify acts of extreme cruelty or genocide. Differences and hostilities are often stylized into absolute enmity by rightwing, racist or religious groups. They have only contempt for their enemy and therefore may have considerably fewer scruples than leftwing terrorists about fighting them with nuclear weapons as well.⁵³ To the extent that it can prevent harm to its own reference group, a fanatic religious group or an ethically motivated unit would probably not shrink back from actions that could cause the death of thousands of mortal enemies.⁵⁴ In previous actions, combatants in ethical or religious minorities have not been deterred either through the abhorrence of world public opinion or by possible retaliatory actions against their countrymen or fellow believers.⁵⁵

7. New Terror Groups

No one knew the "Meinhof-Puig-Antich Group" before it detonated two bombs in the not yet completed nuclear power plant Fessenheim on 3 May 1975 or the "Committee for Pacifism and Ecology" before it fired five missiles at the fast breeder reactor under construction in Creys Malville on 19 January 1982.⁵⁶

Just as today there are terror groups that were unknown 15 years ago, groups will form in the coming decades that will choose terrorist strategies for reasons that are not even conceivable today. Who can rule out that for these groups nuclear terrorism will even be considerably more attractive than it is for the groups that have already carried out nuclear actions?⁵⁷

Ronfeldt and Sater from the Rand Corporation see the greatest danger in the formation of a new terror group recruited from the radicalized members of fanatical religious sects or splinter groups with a racist motivation. In contrast to (5.), their strategy could from the outset be aimed at nuclear actions to carry out their apocalyptic goals, to punish the sinful world, or to achieve a new paradise through the purgatory of a nuclear catastrophe.⁵⁸

What matters is the hereafter, paradise, the future generations or nirvana and not the sinful world in which we live. The first indications for an exclusive orientation toward the hereafter in connection with a fanatical hatred are the suicidal attacks of Shiite terrorists in Lebanon. The increase in this form of fanaticism and hatred toward everything Western in the Islamic world makes a link between science and technology and religious fanaticism seem more and more likely.⁵⁹

In the U.S., fanatical sects are now being classified as a danger similar to many terrorist groups after some of them reinterpreted the Biblical "Armageddon," the final

decisive battle between good and evil, in a nuclear sense in relation to the present. Others are striving for nuclear weapons out of lust for power. This is what one sect's publication states:

"We need even more powerful weapons than atomic or hydrogen bombs...will produce such powerful weapons. If humanity is to survive and if millions of innocent lives are to be saved, then it will be the task of the apostles of peace to use more powerful weapons than they currently possess."⁶⁰

There are already indications of such developments. The German science journalist Schulenberg and the American specialist on sects King consider Lyndon LaRouche's organization to be "probably the only extremist group that would know how to build a hydrogen bomb." Also among the members of LaRouche's National Caucus of Labor Committees (NCLC), its branch in the FRG, the European Workers Party and its many suborganizations are, it is said, nuclear physicists and technicians. Also belonging to this widely ramified organization are the Fusion Energy Foundation and the Fusion Energy Forum. In 1981, its publishing house came out with Friedwardt Winterberg's treatise "The Physical Principles of Thermonuclear Explosive Devices." At the same time, this radical rightwing organization is characterized by an illiberal and anti-Semitic radicalism. The NCLC newspaper "New Solidarity" called for the "stopping of the Jews and British...with force, if necessary, with the means that were used against Japan in 1945."⁶¹

III. Strategies

Assuming that one of the named motives develops in a subnational group, with which nuclear actions could it pursue which objectives meaningful to it?

1. Nuclear Devices

The secret production of a nuclear device is, to be sure, very difficult but it is possible and, in particular, it is feasible with foreign state assistance. The improved technical possibilities of the future will not be limited to the superpowers but will also help such groups carry out their intentions.⁶² None of the international experts is of the opinion that one can rule out the secret production of a functional nuclear device by terrorists. The costs other than the plutonium that would have to be paid for the building of such a device are estimated at about \$10,000 by Friedlander, at \$10,000 to \$30,000 by Hutchinson and Alexander, and about 10,000 pounds sterling by Widdicombe.⁶³

But the question of what strategy could make possible the theft of plutonium and the building and possession of an atomic bomb is raised only very rarely. Most authors are of the opinion that the nuclear threat could be presented credibly enough by the transmission of construction plans or plutonium samples and improves the

bargaining position against the combatted state substantially compared with conventional forms of terrorist action through the greater threat potential.⁶⁴

Mullen asks, on the other hand, what terrorists can achieve through the terror of mass murder that they could not achieve through ordinary military and guerrilla methods—with less risk, at less cost and without inciting public disgust and provoking the state into political reactions that are disastrous for the terrorists as well. In his opinion, there is no attractive nuclear strategy for it.⁶⁵

Jenkins and Rubin judge the possibilities of a sensible strategic implementation of a terrorist nuclear threat just as skeptically, although not so unequivocally. It is true that the bomb is a powerful means of coercion that allows them to hold large parts of the population hostage for their demands. But what demands should they raise to fully utilize this enormous threat potential? Forcing the freedom of a handful of prisoners or demanding a few million is not worth the risk and the expenditures required to divert the necessary plutonium and to produce a nuclear device. At the other end of the spectrum, no doubt, there are worthwhile demands that a government can never fulfill no matter how great the threat may be. In addition, the demand would have to be limited, for an action or a decision can be demanded only when it can be carried out or made immediately or at least relatively quickly and cannot be reversed when the threat no longer exists. For this reason, it would probably be very difficult actually to force a political change through a nuclear threat unless they intend to maintain the threat. But any government can probably meet a demand only if it can be certain that the nuclear threat is thereby at an end. For a subnational group, therefore, a nuclear weapon is probably not a suitable means for changing national policy permanently, for overthrowing a government, or for an ethical minority to gain a homeland by force. Jenkins and Rubin therefore assume that nuclear weapons are of only slight strategic benefit for terrorists. In negotiations, their enormous destructive power can be converted into approximately comparable gains only with difficulty.⁶⁶

For them, however, this judgement is not a final assessment of the probability of nuclear terrorist actions. Because, on the one hand, it is by no means ruled out that in a specific historical situation a subnational group could resolve the dilemma of an atomic bomb strategy, namely, to raise demands that can be met in the short term, endure after they are fulfilled and are worth the great expenditure, at the same time giving the government adequate security that the nuclear threat is thereby over.⁶⁷ On the other hand, they consider other nuclear actions such as the theft of plutonium, sabotage and the takeover or destruction of a nuclear technical installation as the most attractive form of terrorist action from the point of view of the publicity effect.⁶⁸

Schelling, on the other hand, assumes that no one has yet thought through all of the strategic possibilities that could make a nuclear weapon available to the most diverse groups. It is to be assumed, rather, that a group that can overcome the difficulties in manufacturing an illegal atomic bomb is also able to develop a well-conceived strategy. It would wait very patiently for the right opportunity or possibly even try to bring it about itself.

It would plan a nuclear campaign and not an individual episode. In contrast to most terrorist actions in recent years, the action after the announcement or demonstration of a nuclear weapon would probably not culminate in the decisive fulfillment of a single demand ending the episode. Rather, neither the failure nor the success of the nuclear blackmail would necessarily lead to the surrender or confiscation of the bomb. But even if in this way the bomb were to be lost or detonated, no one could be certain that this would exhaust the group's arsenal. If a subnational group acquires the capacity to use nuclear weapons, this is rather more likely to create a permanent threat situation than to bring about a limited event. An organization that can credibly claim to possess nuclear weapons may rise to the status of a government and seek to maintain its existence as a "nuclear minstate" even without people and land.⁶⁹

How and for what purpose could such a group use its nuclear capacity? It could achieve worldwide publicity for itself and its cause, the spread of fear and panic, and recognition as a negotiating partner merely through the credible assertion that it possesses nuclear weapons. It could make its claim believable by revealing details of the theft of plutonium, by sending plutonium samples or construction plans for a nuclear device, or finally by detonating a bomb somewhere as a demonstration of its capabilities. Merely the announcement that it has nuclear weapons or the threat to use them against the population directly or indirectly would lead to panic, mass flight, political pressure against the government, and massive civil disobedience or even resistance. The strongest means of intimidating the government would be to detonate a bomb over a living target as the U.S. did in Hiroshima and Nagasaki. Just as then, when the purpose of the atomic bomb explosions was not to eliminate the two cities but the real objective was the imperial palace in Tokyo and even beyond that the Kremlin, the destruction of the center of a major city would likely also make a resolute government ready to negotiate and to comply.⁷⁰

If the organization wants to intervene in international and above all military conflicts or to avoid discrediting its cause, then it will likely justify its nuclear armament or even the use of its weapons by stating that it is limiting their use to military targets. Just as the nuclear powers officially keep their weapons in readiness only for the state of defense, the group could also limit its threat to

the deterrence of military actions. In this way, it would be conceivable that it would not appear less humane and legitimate than the superpowers.

A terrorist use of nuclear power is probably much more suitable for deterrence than as a means of coercion. Whereas deterrence is supposed to influence an adversary to refrain from doing something, coercion is aimed at inducing him to do something positive. Whereas the order to do something always requires the indication of when, where, how much, how far, etc., the call to refrain does not have to be further specified and often does not even have to be expressed; it is determined by the existing reality. Furthermore, a threat with the goal of deterrence is more credible. Deterrence not only minimizes communications problems and the need to interpret demands but also permits the establishment of a threat without additional hostile acts, with no concessions, and even despite the disputing of the threat.

2. Bombardment of Technical Nuclear Facilities and Transportation

A nuclear strategy similar to that with the help of nuclear devices could be pursued through the bombardment of technical nuclear facilities. In 1987, for example, the U.S. Army presented a highly effective armor-piercing shaped-charge weapon costing only \$30,000. The Fog-M is a missile 1.5 meters long equipped with a video camera and a special roll with 10 km of glass fiber cable as thin as fishing line. The gunner can thereby guide the device precisely into the target on his viewing screen with a joystick.⁷¹ In view of the expected further improvement of such weapons in coming years and decades, nuclear campaigns could become possible in which after a successful demonstration the destruction of additional facilities is announced and the nuclear power plants are used as pawns in a permanent nuclear blackmail. The possibility of destroying a reactor gives every aggressor nuclear striking power.⁷²

The bombardment of a technical nuclear facility might be even more attractive than other forms of action, because it is more a continuation of terrorist traditions and less dangerous to the perpetrators themselves. It could find a prototype in the firing on the Spanish Ministry of Defense with 11 antitank rockets by the ETA in July 1986,⁷³ in the mortar attack against the police station in the Northern Ireland town of Castleberg by the IRA in December 1985⁷⁴ or the attack against the fast breeder in Creys-Malville in January 1982.⁷⁵ This form of action makes it possible to attack any technical nuclear facility from a safe distance regardless of how well guarded and protected it is.⁷⁶ It has the disadvantage, however, that the action is locally linked to the installations and cannot be directed against the actual targets.

Attacks against or firing upon the transportation of burned out fuel elements would be less localized and easier to carry out. With the most up-to-date portable

armor-piercing weapons that will be improved even more in the future or with modern and large sticky charges, perpetrators would be able to penetrate containment and to release parts of the fission products contained in the burned-out fuel elements.⁷⁷ Even though the possible physical consequences of such an action would be substantially less than those after the destruction of a technical nuclear facility or even after the explosion of a nuclear device, the political unrest and the psychological effects would probably be considerable.⁷⁸

Because of the suicidal actions of highly motivated terrorists in the recent past, one cannot rule out attacks in which trucks filled with several tons of explosives penetrate the installation grounds and are exploded there. A study carried out by Scandia National Laboratories on behalf of the Nuclear Regulatory Commission in 1984 came to the conclusion: "It is possible that a relatively small quantity of explosives from a short distance and a still-conceivable larger quantity from a greater distance (greater than the distance to the installation fence at most facilities) would cause unacceptably large damage to indispensable security installations."⁷⁹ This danger cannot be eliminated merely with a few tubs of flowers on the access road. On the contrary, it requires structural improvements of the facilities themselves.

As a rule, to be sure, nuclear power plants in the FRG are better protected against external influences than U.S. reactors, so that this study cannot be applied unseen to the installations here. Nevertheless, this danger should give reason to carry out such a study here as well and to draw the appropriate conclusions from it. Important subsystems relevant to security are also found outside the thick reactor sphere and are thus without protection against a strong shock wave. For older reactors in particular, there are doubts whether even their concrete shielding would hold up to the greatest possible pressure of a truck bomb. In 1980, for example, the administrative court in Kassel rejected compact storage in the nuclear power plant Biblis A, because the concrete jacket only 65 cm thick could not stand up to an explosion in a gas tanker on the Rhine only 420 meters away.⁸⁰

3. Occupation and Destruction of Technical Nuclear Facilities and Transportation

Although through fortunate circumstances there has not yet been a release of radioactivity, the bombing attacks against the 70-megawatt experimental reactor *Monts d'Arée* in France on 15 August 1975, the detonation of a 50-kg bomb in the Spanish factory "Equipos Nucleares" on 11 November 1979, the bomb blasts in the turbine room of the nuclear power plant at *Lemoniz* by members of the ETA on 13 June 1979, the attack of the Argentine "Revolutionary People's Army" against *Atucha* on 25 March 1973, the destruction that a mentally disturbed person caused in the Indian *Tarapur* nuclear power plant in 1969 and the occupation of the "Darlington Nuclear Generating Station" in Canada by 11 Greenpeace members on 7 June 1980⁸¹ show that it was possible in the

past to penetrate well-secured technical nuclear facilities as well. The military and paramilitary commando raids against strongly protected facilities investigated by the Rand Corporation, which were carried out by an average of 27 participants, had a success rate of 80 percent. The success of the raids shows that extremely well-equipped, trained and informed commandos that know how to utilize the element of surprise are indeed in a position to overcome strong security systems that are considered insurmountable. State agents and existing terror groups have shown that they are capable of such commando raids.⁸² The conquest and destruction of a technical nuclear facility or transport must be considered a plausible and feasible terrorist action. It can lead to the release of large quantities of radioactivity.⁸³

The capture of a transport facility for burned-out fuel elements combined with the threat to destroy it corresponds more closely to the customary notions about terrorist blackmail. In its threat potential, however, it would exceed the occupation of an embassy or the hijacking of an aircraft by several magnitudes. The credibility of the threat of blackmail could be increased if the attackers immediately blow open the concrete shell, so that any additional attack against the reactor would become a deadly threat to large parts of the population.⁸⁴

This form of action could, for one thing, be chosen out of a purely destructive intention so as to give a political signal or to stage a terrorist twilight of the gods. But it would also arouse worldwide attention to the group and its goals and put it in a very strong bargaining position if it must be expected that it would also be prepared for a suicidal action.⁸⁵ In this case, however, it is very difficult to imagine the use of the blackmail potential for a nuclear campaign. On the contrary, it will involve a one-time action with the above-mentioned difficulties in demanding acts that can be carried out in the short term, that are verifiable and irreversible, and that are worth the effort.⁸⁶

4. Dispersion

Plutonium is very radiotoxic when inhaled. To be taken up in the lung and to be able to be released in the alveoli, however, plutonium would have to be dispersed into extremely small particles with a diameter of about 0.007 μm .⁸⁷ This is supposed to be possible, for example, through dissemination by means of a conventional explosive or through the burning of a mixture of the smallest plutonium shavings and magnesium.⁸⁸ For this purpose, it is neither necessary to have a critical mass of plutonium nor does it make any relevant difference whether it is reactor or weapon grade and whether it is available as a metal, an oxide or a crystallized nitrate. To contaminate an area, one needs only some plutonium and a dispersion mechanism. It is not simple, however, to disperse it over a larger area. Because of its high specific weight, plutonium tends to fall out of the air quickly. If the plutonium is dispersed very finely and

distributed over a large area, however, the probability per surface area that people will breathe plutonium particles into their lungs will decline. The effectiveness of the contamination depends upon the quantity of the dispersed material, the height from which it is distributed, the distribution density, the particle size, and the local weather conditions and air currents. Even if one can wait for or produce optimum conditions, it is difficult to predict the results of a dispersion in the open.⁸⁹

The most effective and therefore the most probable form of dispersion is probably the infiltration of the plutonium into the air conditioning and ventilation system of a large building. But there are inherent limits to this form of action as well. A substantial quantity of the aerosols will be deposited in the kilometers of conduit of a large air conditioning system, others will be held back by passive or electrostatic filters, and still others will be effected by the humidity in the air, to name just a few of the factors complicating the effective contamination of a building.⁹⁰

There have already been some contamination and dispersion attempts and threats. In Austria in 1974, compartments in several trains and thereby 12 passengers were contaminated with iodine 131. In October 1974, the then Minister of Defense Andreotti informed the Italian parliament that radical rightwing terrorists had intended to poison water lines with uranium. In 1981, an employee of the LaHague reprocessing plant placed radioactive metal plates under the driver's seat of his superior's car, thereby seriously contaminating him. In April 1985, a threat was made in New York to poison the water supply with plutonium. A short time later, an unusually high concentration of plutonium was discovered in the drinking water system.⁹¹

Bombing attacks are a frequently practiced form of terrorist action. An obvious intensification of this action possibility would be to disperse radioactive material with the detonation of a bomb. The action could be prepared and carried out in the usual manner but the results and attention would be increased many times over.⁹²

All experts consider the dispersion of plutonium to be considerably easier than the secret production of a nuclear device. If the building of a bomb turns out to be too difficult for a group that has acquired plutonium, it could, with the necessary instruments and skills, shift to a dispersion strategy. Because of the lesser requirements, a threat to contaminate an area with plutonium would be more credible than the threat with an atomic bomb. The threat potential, however, would be less than that of a nuclear device. No one has yet carried out such an experiment. Nevertheless, it is assumed that the number of victims of a successful dispersion—very much depending upon the quantity dispersed and the specific circumstances—would more likely be in the hundreds than in the thousands.⁹³ It is therefore possible, on the one hand, that an appropriate relationship between

effort, threat and possible consequences may be more achievable than for a threat with an atomic bomb. On the other hand, however, it may also be more difficult to establish such a compelling threat that would make possible a campaign of nuclear blackmail.

As a means of contaminating an area, plutonium represents an enormous threat potential. In only a few cases, however, would dispersion benefit the cause pursued. A specific use is hardly possible. It often works against friend and foe alike and primarily affects those who are least able to resist—children, the sick and elderly. For this reason, the barely calculable results may well be generally counterproductive to the objectives of the perpetrators. Nevertheless, one cannot rule out its use against a definite population group or against a gathering of representatives of the "system" (the German parliament, for example) either out of pure revenge or pure desperation.⁹⁴

The results of the plutonium poisoning do not occur until a later point in time. A few victims will die of fibrosis within days or weeks because of the high doses of toxic contamination but most will die of lung cancer years or decades later.⁹⁵ A much larger number, to be sure, will have to live in fear of being among these victims. In regard to its terrorist success, a plutonium dispersion participates in the fear emanating from the word "plutonium" or "nuclear contamination" but it lacks the immediate and sensational effect, the shedding of blood and the destruction that make the terrorist attacks into an irresistible media event.

It could turn out to be a feasible and reasonable strategy to contaminate physical property. Because of the high costs of a decontamination and the long half-life of plutonium, real estate such as barracks, weapons arsenals or disputed construction sites, manufacturing facilities such as technical nuclear installations or chemical plants, buildings or cultural centers are made inaccessible and unusable for thousands of years. This form of action may have a certain attractiveness especially when the contaminated area or object has a symbolic or material value for the aggressor or the society.⁹⁶

5. Nuclear Bluff

The more plutonium is in circulation, the more probable is the "currently most probable form of nuclear terrorism"⁹⁷: the bluff. For to carry it out, it is neither necessary actually to possess adequate nuclear material and the technical skills nor is it necessary to be determined to carry out mass murder. It is enough to pretend both. According to a statistic of the "National Emergency Search Team" (NEST), U.S. agencies received many atomic bomb threats between 1974 and 1980, of which about 80 were assessed as credible. In two cases, the NEST had to spend days checking into the threatened atomic bombs.⁹⁸

The effects of a bluff would be similar to those of a serious nuclear threat. Merely the believable threat with a nuclear device, with the bombardment or destruction of a nuclear technical facility or a transport or with the nuclear contamination of a city would be sufficient to produce panic, hysteria and political confusion. The massive panic reactions during the crisis in the Three Mile Island nuclear power plant in March and April 1979 indicate the possible consequences of such a threat. Merely the announcement of a nuclear action could be enough to present the government as helpless, incompetent and powerless. How else except through submission should it react when it cannot preclude with full certainty the possibility of the threatened mass murder with certainty?

The blackmailers could make their threat credible by sending to agencies and the press plutonium samples, construction drawings of nuclear devices or dispersion mechanisms, plans of security installations of technical nuclear facilities, or the description of weapons in their possession. The difficulties in distinguishing between a bluff and serious blackmail are extremely great and increase with the number of installations to be protected, the number of employees that may cooperate with the blackmailers, and the quantity of plutonium that is handled and transported daily. It is often impossible to achieve the necessary certainty about the bluff in view of the possible damage. If the press gets hold of the blackmail story and gives extensive coverage to the nuclear threat, its coercive effect would be strengthened substantially. For the incensed population would put the government under extreme political pressure to fulfill the demands of the blackmailers rather than to play poker with the lives of thousands to test the credibility of the threat.⁹⁹

IV. Conclusions

The international experts considered here have seen the danger of nuclear terrorism in a different light since about the end of the 1970's.¹⁰⁰ With just a few exceptions,¹⁰¹ they consider nuclear terrorism to be a real danger that either already exists today or at least one that will become more and more critical in the near future.¹⁰² In their opinion, the danger is increasing constantly.¹⁰³ For "to the extent that the processing of plutonium increases, there is also an increased risk of it falling in the hands of terrorists. To the extent that the capabilities of terrorists increase, it becomes more probable that can use them to build an explosive device."¹⁰⁴

The U.S. Nuclear Regulatory Commission already considers nuclear terror to be a "serious possible threat."¹⁰⁵ Similarly, others characterize it as a "clear and present danger"¹⁰⁶, as an "extraordinary worldwide danger"¹⁰⁷, "perhaps the greatest danger of our age"¹⁰⁸, and even as the "greatest danger for civilization today."¹⁰⁹ In a report to the American Congress in November 1987, the U.S. Department of Defense assesses the danger that terrorists will acquire plutonium or uranium suitable for

weapons and make an atomic bomb out of it as more and more probable.¹¹⁰ For most experts, the question is not whether nuclear terrorism is possible but only when and how often.¹¹¹ "Sometime before the end of the 1980's, a nongovernmental organization will have nuclear weapons. If not in the 1980's, then in the 1990's."¹¹² "Without a drastic change in the handling of fissionable material, the possibility will become a certainty in the next decade or the one after that."¹¹³

This new assessment must lead to consequences. The kind of catastrophes that nuclear terrorism can cause are no longer controllable. They must be avoided by all means. It is therefore important to distinguish what possibilities we have to influence the uncertain risks of the future. Whether or not certain risky installations or transports can be permitted can be decided politically. The future threat from them and the resulting risks for the society, on the other hand, are no longer within the realm of political decisions. Energy policy can, within certain limits, influence and guide the future of the power economy. The reasons for the threat to a plutonium economy, however, are too varied and too complex for them even to be influenced in a similar manner by social and foreign policy. If we want to reduce the risk of catastrophe from nuclear terrorism, then we must start primarily with energy policy.

A great many studies since Chernobyl have shown that the FRG can ensure its energy supply even without nuclear energy. Only the increase in the price of electric current linked with the conversion was assessed differently. For this reason, one should examine carefully whether this relatively slight load is worth putting up with the risks described here. It is by no means justified, however, to enter into the plutonium economy that is linked with a substantial increase in risks and, at the same time, is uneconomical. As the first step in a substantial risk reduction, therefore, one should dispense with the reprocessing facility and the start-up of the fast breeder. A plutonium processing at "Alkem" in Hanau would then no longer be necessary. For we in the FRG should also take seriously the most urgent demand of the "International Task Force on Prevention of Nuclear Terrorism" that no more materials suitable for weapons be processed in the civilian area.¹¹⁴

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His publications include, among others: "Grundrechte und Kernkraftwerke" [Basic Rights and Nuclear Power Plants], Heidelberg, 1979; "Die Aenderungen des Grundgesetzes" [The Changes in the Constitution], Frankfurt,

1981; "Bedroht die Kernenergie unsere Freiheit?" [Does Nuclear Energy Threaten Our Freedom?], Second Edition, Munich, 1983; "Radioaktiver Zerfall der Grundrechte?" [Radioactive Decay of the Basic Rights?], Munich, 1984; "Recht und Technik im Spannungsfeld der Kernenergiekontroverse" [Law and Technology in the Electric Field of the Nuclear Energy Controversy], Opladen, 1984; "Rechtsprobleme der Wiederaufarbeitung" [Legal Problems in Reprocessing], Baden-Baden, 1987; "Die unfriedliche Nutzung der Kernenergie" [The Unpeaceful Use of Nuclear Energy], Hamburg, 1987.

Footnotes

1. Waas, "A 'Nuclear State'" in Michaeli's (publisher) "Handbuch der Kernenergie" [Handbook of Nuclear Energy], 1986, p 1059; also Strassburg, "Legal Aspects of a Future Security System of Technical Nuclear Facilities," ZEITSCHRIFT FUER RECHTSPOLITIK, 1984, p 300.

2. S. Michaelis, "Handbook of Nuclear Energy," 1982, p 866; Waas, "Kernenergie—Ein Votum fuer Vernunft" [Nuclear Energy—A Vote for Reason], 1981, p 176; Waas (Footnote 1), p 1051; Strassburg (Footnote 1), p 33; Hohlefelder, "Possibilities for Abuse in the Operation of a Reprocessing Plant" in Held's (publisher) "Wiederaufarbeitungsanlage Wackersdorf" [Wackersdorf Reprocessing Plant], 1986, starting p 87; Schweinich, "Reprocessing Plant," *ibid.*, starting p 107.

3. For the international literature prior to 1983, see also Rossnagel, "Bedroht die Kernenergie unsere Freiheit? Das kuenftige Sicherungssystem atomtechnischer Anlagen" [Does Nuclear Energy Threaten Our Freedom? The Future Security System of Technical Nuclear Facilities], Second Edition, Munich, 1983.

4. The report and the background papers are published in Leventhal/Alexander, "Preventing Nuclear Terrorism," Lexington, 1987.

5. The contributions to the conference are documented in Leventhal/Alexander, "Nuclear Terrorism—Defining the Threat," Washington, 1986.

6. For more information on this, see Rossnagel, "Die unfriedliche Nutzung der Kernenergie. Gefahren der Plutoniumwirtschaft" [The Unpeaceful Use of Nuclear Energy. Dangers of the Plutonium Economy], Hamburg, 1987, starting p 56.

7. For more on this, see Rossnagel (Footnote 6), p 28 and following pages, p 97 and following pages; Rossnagel (Footnote 3), p 72 and following pages.

8. In this connection, see Rossnagel (Footnote 6), p 24 and following pages, p 76 and following pages; FRANKFURTER RUNDSCHAU, 19th and 20th November 1987.

9. In this connection, see Jenkins, "New Modes of Conflict," Rand Corporation, 1983; Kellen, "The Potential for Nuclear Terrorism: A Discussion" in: Leventhal/Alexander (editors) "Preventing Nuclear Terrorism," 1987, pp 107, 118.

10. In this connection, see Jenkins, "Is Nuclear Terrorism Plausible?" in Leventhal/Alexander (editors), "Nuclear Terrorism—Defining the Threat," 1986, p 26; Brown, "Nuclear Facilities and Materials" in: Evans/Murphy (editors), "Legal Aspects of International Terrorism," 1978, pp 155-156; Kellen (Footnote 9), p 105.

11. In this connection, see Jenkins/Rubin, "New Vulnerabilities and the Acquisition of New Weapons by Nongovernment Groups" in: Evans/Murphy (editors), "Legal Aspects of International Terrorism," 1978, pp 222, 224; Mullen, "Mass Destruction and Terrorism," JOURNAL OF INTERNATIONAL AFFAIRS, Vol 32, No 1 (1978), p 69 and following pages, p 73 and following pages; Alexander, "Super-Terrorism" in: Alexander/Gleason (editors), "Behavioral and Quantitative Perspectives on Terrorism," 1981, p 346; Clark, "Technological Terrorism," 1980, p 107; Wardlaw, "Political Terrorism," 1982, p 175 and following pages; Rossnagel (Footnote 3); International Task Force on Prevention of Nuclear Terrorism, a report in: Leventhal/Alexander (editors), "Preventing Nuclear Terrorism," p 8.

12. S. Despres, "Intelligence and the Prevention of Nuclear Terrorism" in: Leventhal/Alexander (editors), "Preventing Nuclear Terrorism," 1987, pp 322-323; DeVito/Suiter, "Emergency Management and the Nuclear Terrorism Threat," *ibid.*, p 416.

13. In this connection, see International Task Force (Footnote 11), p 8; Walters, "What Nuclear Means and Targets Might Terrorists Find Attractive?" in: Leventhal/Alexander (editors), "Nuclear Terrorism—Defining the Threat," 1986, p 68; Wardlaw (Footnote 11), p 175 and following pages; Jenkins/Rubin (Footnote 11), pp 222, 224; Mullen (Footnote 11), pp 69-70, p 73 and following pages; Alexander (Footnote 11), p 346, Clark (Footnote 11), p 107.

14. See Mark/Taylor/Eyster/Maraman/Wechsler, "Can Terrorists Build Nuclear Weapons?" in: Leventhal/Alexander (editors), "Preventing Nuclear Terrorism," 1987, p 55 and following pages—They have reconfirmed previous fears—in this connection, see, for example, Rossnagel (Footnote 3), p 35 and following pages.

15. Mark et al. (Footnote 14), p 58 and following pages; see also Mullen, "Nuclear Violence" in: Leventhal/Alexander (editors), "Preventing Nuclear Terrorism," 1987, pp 235-236; International Task Force (Footnote 11), p 9.

16. See Mark et al. (Footnote 14), p 63.

17. See, for example, Carlton, "The Future of Substate Violence" in: Alexander/Carlton/Wilkinson (editors), "Terrorism. Theory and Practice," 1979, p 211; Jenkins, "The Potential for Nuclear Terrorism," Rand Corporation, 1977, p 4; Jenkins, "The Consequences of Nuclear Terrorism," Rand Corporation, 1979, p 10; Kessler, "Terrorism and the Energy Industry" in: Alexander/Ebinger (editors), "Political Terrorism and Energy," 1982, p 96; Kellen (Footnote 11), p 114.

18. See Kellen (Footnote 11), p 122.

19. See, for example, Jenkins, "The Terrorist's Mindset and Terrorist's Decisionmaking: Two Areas of Ignorance," Rand Corporation, 1979, p 8; Jenkins (Footnote 10), p 29; Mullen (Footnote 11), p 84; Jenkins/Rubin (Footnote 11), p 231; Wardlaw (Footnote 11), p 177 and following pages.

20. For the following, see also Rossnagel, "Large-Scale Technology and Civic Freedom" in: Daubler-Gmelin/Adlerstein, "Menschengerecht" [Suitable for People], Sixth Legal Policy Congress of the SPD, 1986, p 337 and following pages.

21. For more information in this connection, see Mullen (Footnote 11), p 83 and following pages; Jenkins/Rubin (Footnote 11), p 227; Carlton (Footnote 17), p 209 and following pages; Jenkins (Footnote 19), p 6; International Task Force (Footnote 11), p 13; Goss, "Is Nuclear Terrorism Plausible?" in: Leventhal/Alexander (editors), "Nuclear Terrorism—Defining the Threat," 1986, p 40; Wardlaw (Footnote 11), p 177; Post, "Prospects for Nuclear Terrorism: Psychological Motivations and Constraints" in: Leventhal/Alexander (editors), "Preventing Nuclear Terrorism," 1987, p 98; Jacchia, "European Nuclear Safeguards and Terrorism," *ibid.*, p 259; Rossnagel (Footnote 3), p 56 and following pages.

22. See also Jenkins (Footnote 10), p 30; Post (Footnote 20), p 98; Kellen (Footnote 11), pp 118, 122.

23. Jenkins (Footnote 10), p 28; also Carlton (Footnote 17), p 211.

24. See, for example, Sterling, "Responses to Terrorist Grievances" in: Leventhal/Alexander (editors), "Preventing Nuclear Terrorism," 1987, p 163.

25. See, for example, Jenkins/Rubin (Footnote 11), p 231; Jenkins, "Will Terrorists Go Nuclear?", Rand Corporation, 1976, p 10; Mullen (Footnote 11), p 84; Brown (Footnote 10), pp 159-160; Jacchia (Footnote 20), p 259; Wardlaw (Footnote 11), p 178; Goss (Footnote 20), p 40.

26. See Jenkins (Footnote 10), p 29; only about 1 percent of all terrorist attacks of the last 20 years.

27. In this connection, see evidences and other examples in Rossnagel (Footnote 6), p 66; Rossnagel (Footnote 3), pp 64-65 and Jenkins (Footnote 10), p 29; Jenkins (Footnote 17), p 9, who sees the motives for mass murder primarily with rightwing terrorists.

28. See Jenkins (Footnote 10), p 29; Friedlander, "The Ultimate Nightmare: What If Terrorists Go Nuclear?" *DENVER JOURNAL OF INTERNATIONAL LAW AND POLICY*, Vol 12, No 1 (Fall 1982), p 3; Hoffmann/DeLeon et al., "A Reassessment of Potential Adversaries to U.S. Nuclear Programs," Rand Corporation, 1986, pp 1-2. Whereas 293 terror attacks were reported worldwide for the year 1970, there were 3,010 in 1985. In these 16 years, a total of 25,438 terror attacks were carried out, more than half of them between 1980 and 1985—see Mastrangelo, "Terrorist Activities by Region" in: Leventhal/Alexander (editors), "Preventing Nuclear Terrorism," 1987, p 134. The number of nuclear actions increased in the same ratio as terrorism—see Hoffmann/DeLeon et al., loc. cit., p 7.

29. In this connection, see also Alexander (Footnote 11), p 347.

30. In this connection, see Kellen (Footnote 11), p 122.

31. See International Task Force (Footnote 11), pp 7-8.

32. Also Leventhal/Alexander (Footnote 5), p 2; see also Hirsch/Murphy/Ramberg, "Protecting Reactors from Terrorists," *BULLETIN OF THE ATOMIC SCIENTISTS*, March 1986, p 23; Hoffmann/DeLeon et al. (Footnote 20), p 1.

33. In Rossnagel (Footnote 3), p 55 and following pages, additional situations and motives are noted that do not rule out a nuclear option as a terrorist strategy but allow them to appear probable to one degree or another.

34. See, for example, Livingston, "Megadeath: Radioactive Terrorism" in Alexander/Elhinger (editors), "Political Terrorism and Energy," 1982, p 174; Friedlander (Footnote 28), pp 3-4; Jenkins (Footnote 17), p 7 and following pages; Jenkins (Footnote 10), p 31; Ronfeldt/Sater, "The Mindsets of High-Technology Terrorists," Rand Corporation, 1981, p 26 and following pages; Brown (Footnote 10), p 159; Davies, "Terrorism's Nuclear Potential," paper prepared for the Conference of International Terrorism: The Nuclear Dimension, 25 June 1985, Washington, p 11; Schelling, "Thinking About Nuclear Terrorism, International Security," Vol 6, No 4 (Spring 1982), pp 65-66, 68.

35. In this connection, see also, for example, Denman/Warnock, "Nuclear Power and Civil Liberties," 1982, pp 61-62; Schelling (Footnote 34), p 66 and following pages; Jenkins (Footnote 17), pp 7-8; International Task Force (Footnote 11), pp 33-34; Inga Thorsen in: International Task Force (Footnote 11), p 11; Beres, "Preventing Nuclear Terrorism: Responses to Terrorist

Grievances" in: Leventhal/Alexander (editors), "Preventing Nuclear Terrorism," 1987, pp 147, 151 and following pages; Friedlander, "The Armageddon Factor" in: Beres (editor), "Security for Armageddon," 1986, p 156.

36. See Despres (Footnote 12), p 322.

37. See, for example, Alexander (Footnote 11), p 345; Jenkins/Rubin (Footnote 11), p 231; Davies (Footnote 34), p 1; Jenkins (Footnote 17), p 12; Brown (Footnote 12), p 159; Reinstedt/Westbury, "Major Crimes as Analogs to Potential Threats to Nuclear Facilities and Programs," Rand Corporation, 1980, p 35; Leventhal/Alexander (Footnote 5), p 3; Denton, "International Terrorism—The Nuclear Dimension" in: Leventhal/Alexander (editors), "Nuclear Terrorism—Defining the Threat," 1986, p 154; Friedlander (Footnote 35), p 156.

38. Baumann in an interview, *STERN*, 1 June 1978.

39. Laqueur cited by Alexander (Footnote 11), p 345; in this connection, see also Kellen, "Terrorists—What Are They Like?", Rand Corporation, 1979, p 51; Alexander, "Terrorism, the Media and the Police," *JOURNAL OF INTERNATIONAL AFFAIRS*, Vol 32, No 1 (1978), p 101 and following pages; Wardlaw (Footnote 11), p 76.

40. See, for example, Friedlander (Footnote 28), p 5.

41. In this connection, see, for example, International Task Force (Footnote 11), p 13-14; Office of Technology Assessment, Nuclear Proliferation and Safeguards, 1977, p 127; Alexander (Footnote 11), pp 344-345; Jenkins (Footnote 10), p 30; Jenkins, "The Potential..." (Footnote 17), pp 8-9; Jenkins, "The Consequences..." (Footnote 17), pp 1, 12; Jenkins/Rubin (Footnote 11), p 246; Davies (Footnote 34), pp 2, 11; Friedlander (Footnote 28), p 5; Brown (Footnote 10), p 159; Post (Footnote 20), p 102; Kellen (Footnote 11), p 122; Leventhal/Alexander (Footnote 5), p 3.

42. NRC, "Safeguarding a Domestic Mixed Oxide Industry Against a Hypothetical Subnational Threat," *NUREG 0414*, pp 3-29; Kellen (Footnote 11), p 123.

43. *TIMES*, 20 December 1982; Ramberg, "Nuclear Power Plants as Weapons for the Enemy," 1984, XX.

44. See Alexander (Footnote 12), p 344; Livingstone (Footnote 34), p 153; Carlton (Footnote 17), p 214; Kellen (Footnote 39), p 63; Kellen (Footnote 9), pp 116-117; Jenkins (Footnote 10), p 30; Jenkins (Footnote 9), p 10 and following pages; Jenkins (Footnote 17), p 12; Ronstedt/Sater (Footnote 10), p 159; International Task Force (Footnote 11), p 14; Kellen (Footnote 9), p 113; Post (Footnote 20), p 101.

45. See Livingstone (Footnote 34), p 153; Alexander (Footnote 11), p 345; Ronfeldt/Sater (Footnote 34), p 29; Brown (Footnote 10), p 159; International Task Force (Footnote 11), p 14; Kellen (Footnote 9), p 113; Post (Footnote 20), p 101.

46. See NEW YORK TIMES, 5 June 1985; Jenkins (Footnote 10), p 28.

47. In this connection, see Rossnagel (Footnote 3), pp 58-59; International Task Force (Footnote 11), p 13; Jenkins (Footnote 10), p 30; Jenkins (Footnote 17), p 10.

48. See Ronfeldt/Sater (Footnote 34), p 32; Jenkins (Footnote 17), pp 12-13; Jenkins (Footnote 10), p 30; International Task Force (Footnote 11), p 14; Post (Footnote 20), pp 96, 101; Wardlaw (Footnote 11), p 179. The mechanism of fractioning and radicalization can be understood, for example, in the splintering of the PLO in recent years.

49. See above Footnote 43.

50. See Jenkins (Footnote 10), p 28; Kellen (Footnote 9), p 112.

51. In this connection, see, for example, Livingstone (Footnote 34), p 153; Mullen (Footnote 11), p 85; Jenkins (Footnote 10), p 30; Jenkins (Footnote 17), p 13; Leventhal/Alexander (Footnote 5), pp 3-4; International Task Force (Footnote 11), p 14; Brown, "Is Nuclear Terrorism Plausible?" in: Leventhal/Alexander, "Nuclear Terrorism—Defining the Threat," 1986, p 44, sees no substantial psychological difference between the motivation to kill a few people with a bomb and to murder many with an atomic bomb.

52. See, for example, Bass et al., "The Appeal of Nuclear Crimes to the Spectrum of Potential Adversaries," Rand Corporation, 1982, p 19.

53. See Kellen (Footnote 9), pp 119-120, 122; Jenkins (Footnote 10), p 30.

54. When the Christian militia leader Samir Dischadsha was asked why his men massacred hundreds of defenseless Palestinian women, children and elderly in the Beirut refugee camps Sabra and Schatilla in 1982, he gave the cynical answer: "One does not necessarily kill the people that he wants to kill but those that he can." (See DER SPIEGEL, No 45, 1986, 3 November 1986, p 152, which justifiably points out that the bombardment of the Libyan cities Tripoli and Bengasi by the U.S. was characterized by the same cynical logic.

55. In this connection, see, for example, Jenkins (Footnote 10), p 30; Jenkins (Footnote 17), p 11; Post (Footnote 20), pp 98-99, 102; Wardlaw (Footnote 11), p 179; Rossnagel (Footnote 3), pp 61-62.

56. See, for example, Pilat, "Antinuclear Terrorism in the Advanced Industrial West" in: Alexander/Ebinger (editors), "Political Terrorism and Energy," 1982, pp 198-199; Bass et al. (Footnote 52), p 31; FRANKFURTER RUNDSCHAU 20 January 1982.

57. See, for example, Jenkins (Footnote 10), p 27; Jenkins/Rubin (Footnote 11), p 232; Goss (Footnote 20), p 41.

58. Ronfeldt/Sater (Footnote 34), p 29 and following pages, Jenkins (Footnote 17), p 10; see also Kellen (Footnote 9), p 118; Goss (Footnote 20), p 41.

59. See Brown (Footnote 51), p 45; Friedlander (Footnote 35), p 156.

60. Cited in Rand Corporation, "Why Look At Cults," 1981, p 16.

61. In this connection, see Schulenburg, "Nazis Without Swastikas," West German Radio, November 1983 and King, "Nazis Without Swastikas," 1982, DER SPIEGEL, No 10, 1984, 5 March 1984; Lorscheid/Mueller, FRANKFURTER RUNDSCHAU documentation, 15 December 1986.

62. See, for example, Jenkins (Footnote 10), p 27; Mullen (Footnote 11), pp 64-65; Friedlander (Footnote 28), p 7; Schelling (Footnote 34), pp 64-65; Livingstone (Footnote 34), pp 147-148; Alexander (Footnote 11), p 350; Widdicombe, "Nuclear Power and Civil Liberties" in: Sweet (editor), "The Fast Breeder Reactor," 1980, p 193; Clark (Footnote 1), p 27 and following pages; Carlton (Footnote 17), p 205; International Task Force (Footnote 11), pp 9-10; Mark et al. (Footnote 4), p 55 and following pages.

63. See Friedlander (Footnote 28), p 10; Hutchinson, "Defining Future Threat" in: Alexander/Finger (editors), "Terrorism, Interdisciplinary Perspectives," 1977, p 302; Alexander (Footnote 11), p 350; Widdicombe (Footnote 62), p 193.

64. See, for example, Alexander (Footnote 11), p 345.

65. Mullen (Footnote 11), p 86.

66. Jenkins/Rubin (Footnote 11), pp 231-232; similarly, Jenkins (Footnote 10), pp 31-32; Jenkins (Footnote 17), pp 10, 15 and following pages; Kellen (Footnote 9), p 120; Goss (Footnote 20), p 42; Wardlaw (Footnote 11), p 177.

67. Jenkins (Footnote 10), p 32.

68. Jenkins/Rubin (Footnote 11), p 246; see also Jenkins (Footnote 17), pp 9, 10.

69. See Schelling (Footnote 34), pp 65-66, 68; in this connection, see also Jenkins (Footnote 17), p 19.

70. See Schelling (Footnote 34), pp 69-70; see also Jenkins (Footnote 17), pp 20-21; Friedlander (Footnote 28), p 7.

71. Glasfaser-optisch gelenkte Rakete = fiber-optic guided missile—for more information, see DER SPIEGEL No 24, 8 June 1987, pp 146-147.

72. In this connection, see Hirsch, "The Truck Bomb and Insider Threats to Nuclear Facilities" in: Leventhal/Alexander (editors), "Preventing Nuclear Terrorism," 1987, p 216.

73. See, for example, FRANKFURTER RUNDSCHAU, 22 July 1986.

74. See, for example, TAGESZEITUNG, 21 December 1985.

75. See above Footnote 56.

76. See, for example, Jenkins/Rubin (Footnote 11), p 238.

77. This is also the finding of several investigations by the NRC—see Lahe, "Protection Provided Against Severe Accidents or Sabotage Events During Transportation," paper presented to the annual meeting of the American Nuclear Society, 1984, p 2 and following pages.

78. See, for example, Jenkins/Rubin (Footnote 11), p 234; Ne'eman, "Mobilizing Intelligence Against Nuclear Terrorism" in: Leventhal/Alexander (editors), "Preventing Nuclear Terrorism," 1987, p 333; Mullen, "Nuclear Violence," *ibid.*, p 242; Rossmagel (Footnote 3), p 159 and following pages.

79. Cited by Hirsch (Footnote 72), p 209; Hirsch/Murphy/Ramberg (Footnote 32), p 23.

80. See Constitutional Court, Kassel, "Energiewirtschaftliche Tagesfragen" [Questions of the Day in the Power Economy], 1980, pp 608-609.

81. In this connection, see the evidences in Rossmagel (Footnote 6), p 19 and following pages.

82. See Hoffmann/DeLeon (Footnote 28), p 15.

83. See, for example, International Task Force (Footnote 11), p 9; DeLeon et al., "Attributes of Potential Criminal Adversaries of U.S. Nuclear Programs," Rand Corporation, 1978, p 78 and following pages; Hoffmann/DeLeon (Footnote 28), VII, pp 14-15; Hirsch/Murphy/Ramberg (Footnote 32), p 24; in this connection, see also Denton (Footnote 37), pp 154-155; Rossmagel (Footnote 3), p 80.

84. See Pollack, "Severe Accidents and Terrorist Threats at Nuclear Reactors" in: Leventhal/Alexander (editors), "Preventing Nuclear Terrorism," 1987, p 66.

85. In this connection, see also Denton (Footnote 37), pp 154-155.

strategy, see Rossmagel (Footnote 3), pp 115-125 and 146-151.

87. See, for example, Mullen (Footnote 1), pp 80-81.

88. See, for example, Office of Technology Assessment (Footnote 41), p 146; NRC (Footnote 42), pp 3-37.

89. See Mullen (Footnote 11), pp 79-80; Jenkins/Rubin (Footnote 11), p 232 and following pages.

90. See, for example, Jenkins/Rubin (Footnote 11), pp 232-233; Mullen (Footnote 11), p 80.

91. In this connection, see the evidences in Rossmagel (Footnote 6), pp 44-45.

92. See, for example, Mabry, "Is Nuclear Terrorism Plausible?" in: Leventhal/Alexander (editors), "Preventing Nuclear Terrorism," 1987, p 34.

93. See, for example, Mullen (Footnote 11), p 78 and following pages; Jenkins/Rubin (Footnote 11), p 232 and following pages.

94. See, for example, Mullen (Footnote 11), p 78 and following pages; Jenkins/Rubin (Footnote 11), p 232 and following pages; Jenkins (Footnote 17), p 9.

95. See, for example, Mullen (Footnote 11), pp 82-83.

96. See Jenkins/Rubin (Footnote 11), p 234; Mullen (Footnote 78), p 244; Goss (Footnote 20), p 42.

97. International Task Force (Footnote 11), p 8.

98. See Gates, "The Nuclear Emergency Search Team" in: Leventhal/Alexander (editors), "Preventing Nuclear Terrorism," 1987, p 402; in regard to some of the threats, see Rossmagel (Footnote 6), p 41 and following pages.

99. In this connection, see International Task Force (Footnote 11), p 8; Goss (Footnote 20), p 42; Wardlaw (Footnote 11), pp 175-176.

100. See also the international literature already considered in Rossmagel (Footnote 3) and "Radioaktiver Zerfall der Grundrechte? Zur Verfassungverträglichkeit der Kernenergie" [Radioactive Decay of the Basic Rights? On the Compatibility of Nuclear Energy With the Constitution], Munich, 1984.

101. For example, Carlton, (Footnote 17), pp 201 and following pages, 228 or Mullen (Footnote 11), pp 88-89.

102. The fact that an international "Convention on the Physical Protection of Nuclear Material" was reached on 28 October 1979 especially against the misuse of Nuclear material is probably also based upon a changed assessment. The FRG has not joined this convention.

103. See, for example, International Task Force (Footnote 11), p 8; Gephart, "The New Nightmare: Nuclear Terrorism" in: Leventhal/Alexander (editors), "Nuclear Terrorism—Defining the Threat," 1986, p 146; Taylor, "What Nuclear Means and Targets Might Terrorists Find Attractive?", *ibid.*, p 79; Meurant, "How Can Government and Industry Effectively Respond?", *ibid.*, p 105; Walters, "What Nuclear Means and Targets Might Terrorists Find Attractive?", *ibid.*, p 67; Feld, "How Can Nuclear Violence Be Prevented?", *ibid.*, p 138; Goss (Footnote 20), p 43; Friedlander (Footnote 35), p 156; Spector, "Going Nuclear," 1987, p 5; DeVito/Suiter (Footnote 12), pp 416-417; Despres (Footnote 12), p 324.

104. U.S. Representative Gephart (Footnote 102), p 146.

105. See Asselstine, "How Can Government and Industry Effectively Respond?" in: Leventhal/Alexander (editors), "Nuclear Terrorism—Defining the Threat," 1986, p 102.

106. Justice Goldberg, foreword in: Alexander (editor), "International Terrorism," 1976; cited with approval by Alexander (Footnote 11), p 343; also Nir, "How Can Nuclear Violence Be Prevented?" in: Leventhal/Alexander (editors), "Nuclear Terrorism—Defining the Threat," 1986, p 143; Taylor (Footnote 103), p 79.

107. International Task Force (Footnote 11), p 8; similarly, Despres (Footnote 12), p 321; Hirsch (Footnote 72), p 216.

108. Taylor (Footnote 103), p 79.

109. O'Keefe, "What Can Be Done to Prevent Terrorist Nuclear Violence. Paper Prepared for the Conference on International Terrorism: The Nuclear Dimension," 24 June 1985, Washington, p 8. George Gallup Jr. summarized the result of an opinion poll among 1,346 opinion makers in the U.S. as follows: whereas a war between the superpowers is seen as a real reason for concern, a nuclear catastrophe unleashed by terrorists is considered the greatest impending danger. Cited by Jenkins (Footnote 10), pp 25-26.

110. See FRANKFURTER RUNDSCHAU, 11 November 1987.

111. See, for example, Flowers, "Nuclear Power and the Public Interest: A Watchdog's View," BULLETIN OF THE ATOMIC SCIENTISTS, December 1976, p 27; also Alexander (Footnote 11), p 351; Friedlander (Footnote 28), p 4; Friedlander (Footnote 35), p 156.

112. Schelling (Footnote 34), p 61; agreement by Friedlander (Footnote 28), p 5; similarly, Baker, the former majority leader of the U.S. Senate: "during our lifetime," cited by Livingstone (Footnote 34), pp 145-146; O'Keefe (Footnote 109), p 1.

113. Feld (Footnote 103), p 138.

114. See International Task Force (Footnote 11), p 39 and following pages; for this reason, the American Government renounced the use of plutonium as an energy resource as early as 1977.

9746

IRELAND

Alarm Expressed Over Plutonium Find in UK Rubbish Dump

51500220 Dublin IRISH INDEPENDENT in English
14 Jul 88 pp 1, 2

[Article by Senan Molony: "British Nuke Tip Find Alarms"]

[Text] The discovery of a canister containing plutonium oxide on a "rubbish tip" near Sellafield is a further indication of the utter incompetence of the plant's management, an Irish nuclear power expert said last night.

Professor Robert Blackith of Trinity College said plutonium oxide was just as threatening as the metal itself, which has been described as the most dangerous substance on the planet.

"If any tiny particle gets into the lung or is incorporated into the body, it can cause cancer because plutonium emits alpha-radiation."

The disclosure of the latest lapse at Sellafield came as British Nuclear Fuels, Ltd., announced the closure of one of Britain's oldest nuclear power stations—Magnox power station in Gloucestershire.

Energy Minister Ray Burke said he now looked forward to the closure of the other British nuclear power plants. The government has been pressing for some time for the complete shutdown of the Sellafield plant.

The Sellafield canister was found at a low-level waste site, British Nuclear Fuels Ltd, acknowledged yesterday. The company immediately announced an inquiry into the find at Drigg, West Cumbria.

The canister, unearthed by builders on Monday, is believed to have originated from Sellafield and may have been dumped in breach of disposal safeguards during the 1970s.

The British shadow environment secretary, Dr Jack Cunningham said: "It is absolutely essential that this very serious matter be the subject of a rigorous, open inquiry and that a report of the conclusions should be published as soon as possible."

Professor Blackith said it was "wholly illegal" to dump the canister at Drigg, and absurd to describe the incident as causing no risk to the public, as BNFL had.

"Drigg is a virtual rubbish tip fenced off by wire. It ought never to have been opened, but was set up in these days when the nuclear industry thought it could get away with murder, and very nearly did."

"It is just another indication of the poor quality of management at the plant, despite all the glowing reassurances with which we are constantly supplied."

Prof Blackith pointed out that the Drigg dump had been very heavily criticised in the first report of the Select Committee on Energy in Britain in 1986. When it rains, anything soluble is leaked directly into a local stream, he said. But work was now under way to lay down a new layer of topsoil and control drainage at the tip.

—Meanwhile, Mr Burke has expressed "satisfaction" at BNFL's announcement yesterday that it is closing the old Magnox power station at Brekeley, Gloucestershire. The plant is a 1950s-generation installation, and has come to the end of its usefulness.

/12232

Coverup Alleged on Chernobyl Effect on Eire Farming

51500221 Belfast NEWS LETTER in English
7 Jun 88 p 8

[Text] The Dublin government covered up the real effect of the Chernobyl nuclear disaster on Eire farming, the National Co-operative Council has claimed in Dublin.

As a result, the reputation of Eire food products has been damaged says a report by the council.

Four countries, Mexico, Venezuela, India and Holland, have already rejected Eire produce because of its radio activity, according to the report.

Despite this, there is no restriction on the movement or slaughter of sheep or other animals.

The report demands an immediate independent examination of all farm products to avoid "any further food scandal."

It encloses maps which it says proves Eire was more at risk from radiation than any other parts of the British Isles, including Ulster.

The council said that 758 British farms including 150 in Cumbria involving 300,000 sheep are still subject to restriction.

/12232

TURKEY

Atomic Energy Institute on Contaminated Tea
TA1308182188 Ankara Domestic Service in Turkish
1600 GMT 13 Aug 88

[Text] Attila Ozmen, the chairman of the Atomic Energy Institute, has said that the radioactive 1986 tea harvest which is stored in various warehouses in the Rize region is not an environmental hazard. In a statement after studying the situation in Rize, Ozmen said that thanks to the measures taken, contaminated tea has been prevented from reaching the consumer. He said that by storing the tea in special warehouses, the authorities both solved the CAYKUR's [Tea Producers' Organization] storage problem and placed the contaminated tea in a safe place. He stressed that the 1988 tea harvest is free from contamination, and therefore, there will not be a shortage of tea.

Regarding the barrels that washed ashore in Samsun and Sinop recently, the chairman of the Atomic Energy Institute said that their contents were analyzed and were found not to be radioactive. He said that there were various kinds of paint in the barrels and that it is completely safe to swim at the beaches in the area.

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19 Sept. 1988